U.S. DEPARTMENT OF THE INTERIOR

OFFICE OF WATER RESOURCES RESEARCH
WATER RESOURCES SCIENTIFIC INFORMATION CENTER

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 5, NUMBER 7
APRIL 1, 1972

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

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As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the

Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

INTERFACIAL PROPERTIES OF WATER SOLUTIONS,
Washington Univ., Seattle.
John C. Berg.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402 Price $0.35. Office of Saline Water Research and Development Progress Report No. 724, December 1971. 27 p, 14 fig, 2 tab, 4 ref. OSW Grant No. 14-01-0001-2271.

Descriptors: *Interfaces, *Aqueous solutions, Surface tension, Monomolecular films, Oil-water interfaces, Surfaces, Diffusion, Organic acids, Viscosity, Properties.
Identifiers: Water-organic systems.

Significant progress has been made toward obtaining, correlating, and predicting thermodynamic and transport properties of multicomponent fluid interfaces, particularly aqueous solutions supporting surfactant monolayers. Pi-A data have been obtained for myristic, pentadecylic, palmitic and oleic acids on water-glycerol substrates. The liquid expanded portions of the isotherms have been correlated and predicted using a theoretical model based on Langmuir's duplex film concept and various liquid solution theories. Surface tensions of a number of bulk phase binary solutions are also measured using both the differential capillary rise technique and the drop weight technique. These data are being correlated with two-dimensional adaptations of various solutions theories. Surface diffusivities have been measured for myristic, pentadecylic, stearic and oleic acid monolayers on water and a new theory for monolayer diffusion has been developed. Pi-A and surface viscosity data have been obtained for dipalmitoyl lecithin monolayers on water, the latter by means of a deep channel surface viscometer. Finally, mass transfer data have been obtained for a water-oil system undergoing spontaneous interfacial convection. (OSW Abstract)
W72-03513

THE CURRENT STATUS OF RESEARCH ON WATER AND SALT SOLUTIONS,
Carnegie-Mellon Univ., Pittsburgh, Pa.
R. L. Kay.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price $0.50. Office of Saline Water Research and Development Progress Report No. 648, May 1971. 42 p. OSW Contract No 14-30-2705.

Descriptors: *Water structure, *Aqueous solutions, *Water properties, *Hydrogen bonding, Water chemistry, Electrolytes, Ions, Ion transport, Desalination, Research and development, Programs.

The Office of Saline Water is seeking to develop efficient and economical means for the separation of potable water from salt solutions. One essential aspect of this problem has been a program of fundamental research on water and salt solutions. During the past eight years, the Office of Saline Water has selected and supported a wide range of research projects on water and salt solutions. This report summarizes the Gordon Research Conference on 'The Structural Aspects of Water and Aqueous Solutions,' held during the week of June 15, 1970. It indicates the progress made as a result of the activities of the Office of Saline Water. The current status of knowledge of the properties of water and salt solutions is reviewed by discussing significant changes in viewpoints and resultant accomplishments; recommendations are made concerning priority areas for future research support. Completed projects on specific research topics recommended in the NAS-NRC report, 'Desalination Research and the Water Problem,' are listed. (OSW abstract)
W72-03773

A NUMERICAL METHOD FOR COMPUTING EQUILIBRIA IN AQUEOUS CHEMICAL SYSTEMS,
California Inst. of Tech., Pasadena. W. M. Keck Labs.
For primary bibliographic entry see Field 02K.
W72-03852

02. WATER CYCLE

2A. General

MODELING OF HYDROLOGIC PROCESSES AND WATER SALVAGE PROCEDURES IN SEMIARID REGIONS,
Arizona Univ., Tucson.
M. M. Fogel, J. L. Thames, and L. Duckstein.
Available from the National Technical Information Service as PB-206 121, $3.00 in paper copy, $0.95 in microfiche. Partial Completion Report, December 25, 1971, 31 p, 8 fig, 1 tab, 16 ref. OWRR A-020-ARIZ (4).

Descriptors: *Rainfall, *Frequency analysis, *Distribution patterns, Probability; Runoff; Areal, Seasonal, Monte Carlo method, *Model studies, Time series analysis, Rainfall-runoff relationships, Thunderstorms, *Rainfall disposition.
Identifiers: *Tucson, Chicago, New Orleans.

A methodology is set forth to model and analyze rainfall and runoff events utilizing the basic concepts of probability theory to the general modeling problem. The procedure looks at an event such as thunderstorm rainfall in light of the number of occurrences in a given time period and the magnitude and spatial distribution of each event. A Poisson distribution was found to adequately describe the number of events per season and a geometric distribution for the depth of rainfall at a point per storm. These distributions were then combined to produce an extreme-value distribution for thunderstorm rainfall. Random variables representing rainfall at several points were convoluted to yield mean areal values of rainfall whose distribution was determined to be negative binomial. Chicago and New Orleans data seemed to validate the model developed in Tucson. The above event-based procedure is then used to describe seasonal rainfall combinations of rainfall depths per event and number of events per season. Corresponding likely sets of runoff amounts can then be obtained using watershed models or other appropriate rainfall-runoff relationships. A Monte Carlo simulation can be set up to generate an unordered succession of yearly combinations of events. This synthetic rainfall set is useful for determining the annual water yield, for evaluating runoff modification due to vegetative manipulation and urbanization and determing the effectiveness of water conservation practices such as artificial recharge and water harvesting.
W72-03527

ROLE OF BASEFLOW IN RAINFALL-RUNOFF RELATIONS,
Illinois State Water Survey, Urbana.
K. P. Singh.
Available at ASCE Headquarters, 245 E. 47th St., N.Y., N.Y., 10017, Price $0.50. Meeting Preprint 1291, ASCE National Water Resources Engineering Meeting, January 11-15, 1971, at Phoenix, Arizona. 23 p, 7 fig, 3 tab, 3 ref.

Descriptors: *Rainfall-runoff relationships, *Base flow, *Peak discharge, Runoff forecasting, Soil water, Correlation analysis, Regression analysis, Surface-groundwater relationships, Subsurface runoff.

The role of baseflow in modifying rainfall-runoff relations was studied using data from a number of storms over a basin and establishing correlations between dependent variables such as storm runoff, surface runoff, baseflow runoff, or flood peak, and independent variables such as storm rainfall, initial baseflow, effective and total storm durations, and highest and lowest temperatures during the storm. The initial baseflow, Qbi, is a good indicator of the average soil mositure condition over the basin before the occurrence of storm rainfall. Multiple correlation coefficients for total flood runoff, surface runoff, baseflow runoff, and flood peak with rainfall and Qbi as the independent variables are very significant. The range of Qbi varies from month to month exhibiting the effect of evapotranspiration and other seasonal factors. Inclusion of Qbi in the correlations studied greatly improves the accuracy of dependent-variable estimates. (Knapp-USGS)
W72-03570

RAINFALL/RUNOFF RELATIONSHIPS AT CASS, IN THE SOUTH ISLAND HIGH COUNTRY,
Canterbury Univ., Christchurch (New Zealand). Dept. of Geography.
Jane M. Soons.
In: Wellington Symposium - The Results of Research on Representative and Experimental Basins; December 1-8, 1970, New Zealand: New Zealand Journal of Hydrology, Vol 9, No 2, p 192-201, 1970. 10 p, 5 tab, 6 ref.

Descriptors: *Rainfall-runoff relationships, *Vegetation effects, *Small watersheds, *Regression analysis, Correlation analysis, Evaporation, Evapotranspiration, Infiltration, Base flow.
Identifiers: *New Zealand, *Experimental watersheds.

Some of the results obtained in a four-year period of study of rainfall and runoff in the Chilton Valley, Cass, New Zealand are presented. Data on rainfall and runoff from six sites are used, and together with soil temperature data were analyzed by a stepwise multiple regression. A high correlation between runoff, number of half-hour periods with rainfall intensity greater than 3 mm, maximum half-hourly precipitation intensity, and number of freeze-thaw cycles was established for three plots on the shady side of the valley. Less satisfactory results were obtained for those plots situated on the sunny side. Runoff is the smallest item in the water balance. At well vegetated plots it is unusual for runoff to exceed 3% of the rainfall. Runoff does not appear to be a major factor either in causing soil erosion or in contributing to stream flow, except possibly when unusually severe storms occur. (Knapp-USGS)
W72-03571

STOCHASTIC ANALYSIS OF EPHEMERAL FLOW IN ARID LANDS,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
C. C. Kisiel, L. Duckstein, and M. M. Fogel.
Paper presented at ASCE Water Resources Engineering Conference, Phoenix, Arizona Jan. 11-15, 1971. 39 p, 6 fig, 2 tab, 39 ref. OWRR B-007-ARIZ (13).

Descriptors: *Stochastic processes, *Arid lands, *Operations research, *Mathematical models, *Flow, *Hydrology, *Networks, Distribution patterns, Hydraulics, Meteorological data, Model studies, Arizona.
Identifiers: *Tucson Arroyo.

Recent results were presented in the stochastic analysis of ephemeral flows in the metropolitan area of Tucson, Arizona and a framework proposed for future analyses of such data. A review of system characteristics was given which lead into a discussion of the special problems of parameter estimation in models of arid land flows, the relative importance of different random variables defined as the sequences of observed flow,

and the different approaches to streamflow modeling. A framework was presented for the analysis and modeling of streamflows in arid lands. The basic event series of streamflows as observed in nature was found to be more informative than monthly and annual series. The frequency of summer and winter events at the Tucson, Arroyo gaging station was described respectively by a negative binomial distribution and a geometric distribution. Meteorologically, this result was explained in terms of the temporal and spatial independence of summer thunderstorms on the persistence of winter cyclonic storms. The negative binomial distribution also described the duration of flow per event in both winter and summer. (Ligon-Cornell)
W72-03678

DYNAMIC PROGRAMMING MODEL AND QUANTITATIVE ANALYSIS, ROSWELL BASIN, NEW MEXICO,
New Mexico Inst. of Mining and Technology, Socorro. Hydrology Section.
For primary bibliographic entry see Field 02F.
W72-03770

A FUNDAMENTAL MATHEMATICAL SIMULATION OF WATERSHEDS,
Ohio State Univ., Columbus. Dept. of Agricultural Engineering.
E. U. Nwa.
PhD Thesis, 1971. 155 p, 37 fig, 2 tab, 65 ref, 5 append. OWRR B-005-OHIO (7).

Descriptors: *Soil water movement, *Overland flow, *Watersheds (Basins), *Model studies, Mathematical models, Numerical analysis, Computer programs, Systems analysis, Infiltration, Runoff, Flow rates, Equations.

A watershed model that simulates the soil moisture movement and the overland flow was developed. The Alternating Direction Implicit (ADI) method of numerical analysis was used to analyze the soil moisture aspect of the model and an explicit method was used for the overland flow analysis. The overland flow solution was controlled by the characteristic lines that define a region of convergent solutions. As long as the convergence and stability requirements as expressed by the characteristic equations for overland flow were met, the time increment had an insignificant effect on the runoff rate, but if the characteristic equations were not satisfied, the effect of the time step was serious enough to cause the computer to stop processing the program. The ADI procedure is a very successful method for solving two-dimensional, completely saturated, and completely unsaturated flow problems. The method is also satisfactory for solving, as a unit, problems in which part of the flow region is saturated and the other part is unsaturated. The freedom to choose the space and time mesh sizes to fit particular problems is a significant advantage. (Woodard-USGS)
W72-03911

2B. Precipitation

MODELING OF HYDROLOGIC PROCESSES AND WATER SALVAGE PROCEDURES IN SEMIARID REGIONS,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 02A.
W72-03527

THE FEASIBILITY OF AUGMENTING HYDROLOGIC RECORDS USING TREE-RING DATA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 07B.
W72-03691

ON THE PROGNOSIS OF THE AGRO--METEOROLOGICAL CONDITIONS OF THE WINTERING OF WHEAT AS ONE FACTORS IN THE PREDICTION OF THE CROP,
Hidrometeoroloski Zavod Socijalisticke Republike Bosne i Hercegovine, Sarajevo (Yugoslavia).
For primary bibliographic entry see Field 03F.
W72-03692

2C. Snow, Ice, and Frost

ORTHOPHOTOMAPPING FOR PRUDHOE BAY DEVELOPMENT,
Geological Survey, Anchorage, Alaska. Topographic Div.
For primary bibliographic entry see Field 07C.
W72-03858

SEDIMENTOLOGICAL AND GEOCHEMICAL ASPECTS OF SEDIMENT AND WATER FROM TEN ALASKAN VALLEY GLACIERS,
Alaska Univ., College.
R. M. Slatt.
Available from the National Technical Information Service as PB-206 153, $3.00 in paper copy, $0.95 in microfiche. PhD Thesis, May 1970. 125 p, 17 fig, 14 tab, 94 ref, 4 append. OWRR Grants A-019-ALAS (2) and A-026-ALAS (2).

Descriptors: *Glaciers, *Melt water, *Sediments, *Water quality, *Alaska, Streams, Sediment transport, Erosion, Geology, Particle size, Ice, Mud, Bedrock, Chemical analysis, Hydrologic data, Mineralogy, Sedimentology.

The characteristics of superglacial sediments, suspended stream sediments, and meltwater from ten Alaskan valley glaciers were determined. The glaciers are eroding five different types of bedrock. Superglacial sediments from six glaciers are relatively unmodified, but superglacial sediment from the other four glaciers are mixtures of relatively unmodified glacial sediments and proglacial sediments. Mud is the major component of suspended stream sediments. These sediments are generally poorly sorted and contain distinct size modes. Mean grain size of suspened sediments is a function of glacial stream velocity. Mean Na, K, Ca, Mg, and Si concentrations in the meltwater streams ranged from 9.3 to 37 ppm. The pH, Eh, and temperature ranged from 7.3 to 8.9, +0.42v. to +0.58v., and 0.5 to 3.2 deg C, respectively. In the Norris Glacier tide-affected meltwater system major cation concentrations do not vary appreciably. In the zone of mixing of meltwater and saline Taku Inlet water, however, major cation concentrations increase as a function of the degree of mixing. The clay content, organic matter content, and cation exchange capacity of tide flat sediments are also functions of the relative influence of the marine environment. (Woodard-USGS)
W72-03859

ICE FOG MODIFICATION BY USE OF HELICOPTERS,
Cold Regions Research and Engineering Lab., Hanover, N.H.
J. R. Hicks, and M. Kumai.
Available from NTIS, Springfield, Va 22151 as AD 731 215 $3.00 paper copy. Cold Regions Research and Engineering Laboratory Special Report 162, September 1971. 9 p, 4 fig, 10 ref. DA 1T061102B52A DA 1T062111A126.

Descriptors: *Fog, *Dispersion, *Aircraft, *Alaska, Methodology, Condensation, Mist, Radiation, Temperature.
Identifiers: *Ice-fog dispersal, *Helicopters, Downwash.

During the period January 7-14, 1971, two series of ice fog dispersal tests were conducted near the Fairbanks and Ft. Wainwright, Alaska, area. A CH-47 Chinook helicopter flying just above the fog was used to produce the needed downwash. An Army UH-1 helicopter flying about 130 m above and behind the CH-47 was used to carry the flight director who also was the observer and photographer. Several targets were used with varying heights, airspeeds, and flight patterns. The first attempt to clear an area was the most successful. Repeated passes did not improve the visibility; in fact, they usually caused a denser, turbulent appearance in the stirred area, even though no direct condensation or vapor trail was observed behind the helicopter. In all cases, the clearings remained open for less than one minute. (Woodard-USGS)
W72-03870

ONE DIMENSIONAL WATER FLOW THROUGH SNOW,
Cold Regions Research and Engineering Lab., Hanover, N. H.
S. C. Colbeck.
Available from NTIS, Springfield, Va 22151 as AD 730 304 $3.00 Paper copy. Cold Regions Research and Engineering Laboratory Research Report 296, August 1971. 17 p, 10 fig, 15 ref. DA 4A061102B52E02.

Descriptors: *Glaciers, *Snow, *Water yield, *Percolation, *Theoretical analysis, Porous media, Porosity, Snowmelt, Analytical techniques, Water measurement, Snowpacks, Runoff, Water yield.
Identifiers: One-dimensional flow.

A theory is developed to describe the percolation of water through isothermal snow with a vertical porosity gradient. Concepts from the general theory of two-phase flow through porous media are used in the development. The general solution for the one-dimensional problem is given, which, when combined with any periodic boundary condition, can be used to make quantitative predictions. The theory is applied to water percolation through firn on the upper Seward Glacier. Using appropriate values for the parameters, the theory shows a wave of volume flux which travels down into the firn and distorts with depth. The rate at which the waves propagate is calculated using the method of characteristics and is in fair agreement with the observed rate where the permeability of the bulk firn with ice layers is reduced by a factor of two over homogeneous snow samples studied in the laboratory. The theory predicts that the waves advance with a shock front which grows with depth. The shock front is thought to be only an approximation to the actual physical process. (Woodard-USGS).
W72-03871

GLACIOLOGICAL LITERATURE.

Journal of Glaciology, Vol 9, No 56, p 289-300, June 1970. 231 ref.

Descriptors: Bibliographies, *Glaciers, *Glaciation, *Snow, *Ice, Permafrost, Frozen ground, Snowpacks, Avalanches.
Identifiers: *Glaciology.

A selected list of glaciological literature on the scientific study of snow and ice and of their effects on the earth is presented. The bibliography includes instrumentation, ice physics, glaciers, ice shelves, icebergs, sea ice, river ice, glacial geology, frost action, frozen ground, permafrost, and snow. (Knapp-USGS)
W72-03881

FRONTAL RECESSION OF SERMIKAVSAK, WEST GREENLAND,
Saint Andrews Univ. (Scotland). School of Physical Sciences.
P. W. F. Gribbon.
Journal of Glaciology, Vol 9, No 56, p 279-282, June 1970. 2 fig, 6 ref.

Descriptors: *Glaciers, *Movement, *Regimen, *Surveys, Topography, Profiles, Ablation, Glaciation.
Identifiers: *Greenland.

The results of two surveys of the frontal margin of a valley glacier in West Greenland are reported. The local glaciers have shown stability or slight recession from their maximum extent during A.D. 1920-30; and in particular on Upernivik the glaciers have shown a large re-advance around 1930 followed by a subsequent retreat at about 30 m/year. However, since 1960 there is evidence that a new re-advance may be under way on the larger nearby glacial lobes from the ice sheet. Although the measurements and conclusions are not inconsistent with the stability or possible re-advance of the ice, the short-term variations of one glacier are not a reliable guide to the glaciation over a wide region and continued studies over the glaciers of the region would be of interest. (Knapp-USGS)
W72-03882

ELECTRICAL PHENOMENA ACCOMPANYING THE PHASE CHANGE OF DILUTE KCL SOLUTIONS INTO SINGLE CRYSTALS OF ICE,
Saint Louis Univ., Mo.
For primary bibliographic entry see Field 02K.
W72-03884

SCREEN TEMPERATURES AND 10M TEMPERATURES,
Ohio State Univ. Research Foundation, Columbus. Inst. of Polar Studies.
F. Loewe.
Journal of Glaciology, Vol 9, No 56, p 263-268, June 1970. 4 tab, 44 ref.

Descriptors: *Temperature, *Arctic, *Antarctic, *Snowpacks, *Meteorological data, Air temperature, Firn, Snowfall, Climatology, Glaciers, Glaciation.
Identifiers: Greenland, Antarctica.

At places with an annual mean temperature lower than -20 degrees C on the Greenland and Antarctic ice sheets, the temperature at a depth of 10 m is close to the annual mean at the surface and at the level of the meteorological shelter. Where temperatures are higher than about -35 Degrees C the size and sign of the differences vary. With lower temperatures, the 10 m temperature becomes increasingly lower than the air temperatures. At the coldest Antarctic station (Plateau), they differ by nearly 4 degrees. (Knapp-USGS)
W72-03885

MASS BALANCE OF THE WARD HUNT ICE RISE AND ICE SHELF: A 10 YEAR RECORD,
Defense Research Establishment Ottawa (Ontario).
G. Hatterley-Smith, and H. Serson.
Journal of Glaciology, Vol 9, no 56, p 247-252, June 1970. 2 fig, 2 tab, 11 ref.

Descriptors: *Water balance, *Regimen, *Glaciers, *Arctic, Hydrologic budget, Glaciation, Snowfall, Ablation, Movement, Data collections, Surveys, Topography, Climates, Hydrologic data.
Identifiers: *Ellesmere Island (Canada), Ward Hunt Ice Shelf.

The results of 10 years' (1958-68) record of accumulation and ablation from the Ward Hunt ice rise and of 3 years' (1965-68) record from the Ward Hunt Ice Shelf are presented. The net mass balances on the ice rise for the 3 years 1962-65 are positive, while the net mass balances measured in the other years on both ice rise and ice shelf are all negative. Quite small deviations from mean summer temperature appear to determine whether the mass balance is positive or negative, and for this reason neither ice rise nor ice shelf should be considered as a relict glacial feature. (Knapp-USGS).
W72-03886

ON THE DEPOSITION OF SUBGLACIAL AND MELT-OUT TILLS AT THE MARGINS OF CERTAIN SVALBARD GLACIERS,
University of East Englia, Norwich (England). School of Environmental Sciences.
G. S. Boulton.
Journal of Glaciology, Vol 9, No 56, p 231-245, June 1970. 8 fig, 10 ref.

Descriptors: *Till, *Sedimentation, *Sediment transport, *Glaciers, Glaciation, Provenance, Sedimentary structures, Stratigraphy, Deposition (Sediments), Melting, Ablation, Ice.
Identifiers: Svalbard.

Two types of basal till are described. Melt-out tills are released by the melting of masses of buried, debris-rich stagnant ice. Top melting of these ice masses produces tills which retain some of their englacial fabrics although some are changed by the melting process. Bottom melting could also produce such tills but these are likely to be much less important. Secondly, tills are also formed subglacially when basal debris-rich glacier ice becomes stationary beneath the overriding active glacier. When these subglacial masses melt, water is expelled from the resultant till, which shows tectonic shear fractures induced by the overriding ice. The mode of deposition of these tills could also be responsible for the production of rock-cored drumlins. Subglacial tills in Svalbard are relatively rare and, except under special conditions, are likely to react to ice loading by water expulsion, compaction and shear fracture rather than by fluid flow. If a basal freezing hypothesis is accepted for the origin of most englacial debris, the lateral and vertical variations in erratic-particle content can be predicted for many melt-out tills. (Knapp-USGS)
W72-03887

ON THE ORIGIN AND TRANSPORT OF ENGLACIAL DEBRIS IN SVALBARD GLACIERS,
University of East Anglia, Norwich (England). School of Environmental Sciences.
G. S. Boulton.
Journal of Glaciology, Vol 9, No 56, p 213-229, June 1970. 7 fig, 1 tab, 26 ref.

Descriptors: *Glaciers, *Scour, *Sediment transport, *Provenance, Glacial drift, Ice, Sediments, Till, Erosion, Glaciation.
Identifiers: Svalbard, Ice caps.

Considerable amounts of debris derived from the glacier bed are contained in the polar glaciers of Svalbard. It is suggested that this debris is largely incorporated by basal freezing on the down-glacier flanks of bedrock obstructions, although other freezing mechanisms and thrusting may be important. The basal freezing hypothesis predicts that certical and lateral variations in englacial debris content should reflect the variation in subglacial rocks over which the glacier passes; this prediction was tested against an actual englacial debris sequence. The mode of transport of debris, including its stone orientation fabrics, is described, and also the way in which it reacts in zones of intense compression. Polar glaciers tend to contain much larger amounts of basally derived debris than temperate glaciers. This supports the view that the englacial incorporation of debris is controlled by the temperature regime of the glacier, and could be of considerable importance in the interpretation of the regimes of ancient glaciers from their deposits. (Knapp-USGS)
W72-03888

CHANGES IN THE BEHAVIOR OF THE UNTERAARGLETSCHER IN THE LAST 125 YEARS,
Naturforschende Gesellschaft in Zurich (Switzerland). Gletscherkommission der Schweiz.
R. Haefeli.
Journal of Glaciology, Vol 9, No 56, p 195-212, June 1970. 16 fig, 3 tab, 25 ref.

Descriptors: *Glaciers, *Movement, *Regimen, Hydrologic budget, Flow, Melting, Ablation, Snowfall, Surveys, Data collections, Hydrostatic pressure, Melt water, Profiles.
Identifiers: *Unteraargletscher (Switzerland).

Measurements were made of the tongue of the Unteraargletscher between its end and 2,600 m a.s.l. The total loss of volume of the Unteraargletscher since its last maximum advance (1871) is estimated to be 2.4 cu km which corresponds to a mean surface lowering of 0.67 m/year. The considerable slowing down of the glacier flow velocity over the 125 years is primarily attributable to the marked decrease in the sliding component, whereas the shear component has only changed slightly. This behavior is connected with the fact that the decrease in ice thickness has been accompanied by an increase in surface slope, so that the two effects on the shear component partially compensate each other. The seasonal variations in surface velocity were measured simultaneously at two profiles by Agassiz and his team in 1845/46. These variations are due to the variable amount of melt water and the resulting variations in hydrostatic pressure in the contact zone between ice and bedrock, in which the plastic contraction of the water channels plays a decisive role. This leads to the problem of water circulation in the interior of a glacier and its importance in the sliding process. A simple method is given for the approximate calculation of the longitudinal profile of the surface of a glacier tongue in a steady state and with constant ablation. (Knapp-USGS)
W72-03889

A SLIP-LINE FIELD ANALYSIS OF THE DEFORMATION AT THE CONFLUENCE OF TWO GLACIER STREAMS,
Manchester Univ. (England). Dept. of Mathematics; and Manchester Univ. (England). Inst. of Science and Technology.
I. F. Collins.
Journal of Glaciology, Vol 9, No 56, p 169-193, June 1970. 23 fig, 25 ref.

Descriptors: *Glaciers, *Flow, *Deformation, Ice, Rheology, Plasticity, Plastic deformation, Stress, Strain, Shear, Topography.
Identifiers: *Kaskawulsh Glacier (Canada), Glacier confluences.

The deformation and state of stress at the confluence of two glacier streams are analyzed using the techniques of slip-line theory. The valley walls are assumed to be vertical parallel planes and the deformation is independent of depth. The mechanical behavior of ice is modelled by the ideal rigid/perfectly plastic material. Detailed solutions are presented for the deformation at the confluence of one or more tributaries with a main stream and of two main streams, predicting the number, position and magnitude of the bands of intense shear which emanate from some of the junction corners. The predictions of this idealized theory are compared with field data from a confluence on the Kaskawulsh Glacier, Yukon Territory, Canada. (Knapp-USGS)
W72-03890

THE LOCATION AND TIMING OF DEEP SLAB AVALANCHES,
Montana State Univ., Bozeman. Dept. of Earth Sciences.
C. C. Bradley.
Journal of Glaciology, Vol 9, No 56, p 253-261, June 1970. 9 fig, 6 ref. GP3692, and NSF Grants GA 756.

Descriptors: *Avalanches, *Snowpacks, Montana, Slopes, Topography, Seasonal, Weather, Solar radiation, Shear strength, Mechanical properties, Yield strength.
Identifiers: *Deep slab avalanches, Snow structure, Snow metamorphism.

Winter observations in the northern Rocky Mountains of Montana show two periods during which a

collapsing snowpack and accompanying avalanches may be expected: (1) shaded and sheltered areas during December to February; (2) sunny and exposed areas during March to May. This appears to be linked in part to the cyclic rise and fall of strength in the basal snow layer. It is suggested that sheltered slopes are often about a half-cycle ahead of sunny slopes because sheltered slopes tend to retain the early snows which later become the critically weak basal layer on these slopes. (Knapp-USGS)
W72-03892

WIND TIDES IN THE ESTUARINE AREA OF THE PREGEL RIVER (SGONNO-NAGONNYYE KOLEBANIYA UROVNYA V UST'YEVOY OBLASTI R. PREGOLI),
State Oceanographic Inst., Moscow (USSR).
For primary bibliographic entry see Field 02L.
W72-03899

MORPHOLOGY OF THE ICE-SHEET MARGIN NEAR THULE, GREENLAND,
Minnesota Univ., Minneapolis. Dept. of Geology and Geophysics.
R. L. Hooke.
Journal of Glaciology, Vol 9, No 57, p 303-324, October 1970. 13 fig, 5 tab, 23 ref.

Descriptors: *Glaciers, *Geomorphology, *Topography, *Sedimentary structures, *Glacial drift, Till, Ice, Regimen, Sediment transport, Snowfall, Ablation, Movement, Water balance, Flow.
Identifiers: *Greenland, *Greenland ice sheet.

Three types of glacial margin are found along the edge of the Greenland ice sheet near Thule: ice cliffs, ramps and ice-cored moraines. Where the glacier margin is perpendicular to prevailing katabatic winds, drifting snow accumulates along it in stagnant wind-drift ice wedges. Upward flow of active ice behind these wedges causes ice originally near the base of the glacier to rise to the surface. Where the basal ice is free of debris, a gently sloping ramp develops. However, where the basal ice contains sufficient debris, a layer of till accumulates on the glacier surface. Ice beneath the till is insulated and a debris-capped ice ridge or ice-cored moraine forms. Ice cliffs occur where the ice-sheet margin is parallel to prevailing winds and is thus swept clear of drifting snow. Although the ice sheet in the Thule area has had a negative mass balance for many years, all three types of glacier margin are equilibrium forms that can develop and persist on a glacier with a balanced mass budget. (Knapp-USGS)
W72-04039

THE MASS BALANCE OF THE DEVON ISLAND ICE CAP, NORTHWEST TERRITORIES, CANADA, 1961-66,
Department of Energy, Mines and Resources, Ottawa (Ontario). Polar Continental Shelf Project.
R. M. Koerner.
Journal of Glaciology, Vol 9, No 57, p 325-336, October 1970. 9 Fig, 4 tab, 8 ref.

Descriptors: *Glaciers, *Water balance, *Regimen, Surveys, Snowfall, Ablation, Snow, Ice, Firn, Dye releases, Stratigraphy, Movement.
Identifiers: *Mass balance (Glaciers), Canada, Devon Island.

Methods used in measuring the mass balance of the Devon Island ice cap, Canada are described. The northwest part of the ice cap was studied in most detail and has had a slightly negative net balance for the period 1961-66. An inverse relationship exists between mean net balance and elevation of the equilibrium line in the northwest part of the ice cap. The mean net balance there should be zero with an equilibrium line at 920 m elevation. Accumulation on the ice cap is greatest in the southeast but the mean net balance there is similar to the mean net balance on the rest of the ice cap. The present accumulation pattern must have existed for several hundreds, and possibly thousands of years. Between 1961 and 1966 only 1962 had a more negative mean net balance than the average value for the period 1934-60. During the same 26 year period the net balance at 787 m elevation has varied, but summer conditions do not appear to have changed significantly. (Knapp-USGS)
W72-04040

FLUCTUATIONS OF COLEMAN GLACIER, MT BAKER, WASHINGTON, U.S.A.,
Washington Univ., Seattle. Dept. of Electrical Engineering.
A. E. Harrison.
Journal of Glaciology, Vol 9, No 57, p 393-396, 1970. 3 fig, 1 tab, 2 ref.

Descriptors: *Glaciers, *Washington, *Regimen, Ablation, Snowfall, Movement, Water balance, Variability, Data collections, Surveys.
Identifiers: Coleman Glacier (Wash).

Thickness variations above an ice fall in the terminal tongue of Coleman Glacier on Mt Baker, Washington, have been quite small (plus or minus 5 m) in contrast to the rapid expansion and shrinkage of the tongue itself during the last 20 years. The tongue has not responded as actively to recent, larger thickness changes above the ice fall as it did during its period of most active expansion between 1954 and 1956. There is no apparent relationship between the glacier thickness and the type of flow in the terminal tongue. (Knapp-USGS)
W72-04041

A TECHNIQUE FOR PRODUCING STRAIN-FREE FLAT SURFACES ON SINGLE CRYSTALS OF ICE,
Cold Regions Research and Engineering Lab., Hanover, N.H.
T. M. Tobin, and K. Itagaki.
Journal of Glaciology, Vol 9, No 57, p 385-390, 1970. 6 fig, 6 ref.

Descriptors: *Cryology, *Ice, *Crystallization, *Strain, Diffusion, Mass transfer, Crystallography, Freezing.
Identifiers: Strain-free surfaces (Crystals).

To produce strain-free flat surfaces on ice crystals, the top surface of an accurately aligned ice crystal is melted by an aluminum surface and then frozen to a warm 'Lucite' plate and tapped free. The dislocation density on the resulting surface as shown by etching is similar to the bulk dislocation density determined by X-ray topographic methods. (Knapp-USGS)
W72-04042

RENEWED ACTIVITY OF MULDROW GLACIER, ALASKA, AFTER THE 1956 SURGE,
Washington Univ., Seattle. Dept. of Electrical Engineering.
A. E. Harrison.
Journal of Glaciology, Vol 9, No 57, p 397-400, 1970. 2 fig, 9 ref.

Descriptors: *Glaciers, *Movement, *Regimen, Water balance, Ablation, Snowfall, Surveys, Flow, Rheology, Alaska.
Identifiers: Glacial surges.

The Muldrow Glacier is rapidly recovering its thickness after a recent surge in the area below the lower Muldrow ice fall. About one-third of the lost ice thickness at the base of the ice fall has been replaced during the 10 years since the surge. The ice velocity in this region is apparently quite rapid, but quickly decreases downstream and is barely detectable at McGonagall Pass, 6.5 km from the base of the ice fall. Muldrow Glacier offers an excellent opportunity to study the recovery from a surge, and the flow of a normal wave into stagnant ice. (Knapp-USGS)
W72-04043

FINGER-RAFTING IN FRESH-WATER ICE: OBSERVATIONS IN LAKE SUPERIOR,
Minnesota Univ., Duluth. Dept. of Geology.
J. C. Green.
Journal of Glaciology, Vol 9, No 57, p 401-404, 1970. 4 fig, 5 ref.

Descriptors: *Iced lakes, *Lake Superior, *Lake ice, Minnesota, Freezing, Ice, Waves (Water).
Identifiers: *Finger-rafting (lake ice).

Finger-rafting, similar to that reported in sea ice, is common in thin (2-15 mm) new ice on Lake Superior. It is produced by wind traction alone; neither wave action nor brine is necessary for its initiation or propagation. Fingers have been observed to progress at rates of 0.5-5 cm/s. (Knapp-USGS)
W72-04044

2D. Evaporation and Transpiration

POSSIBLE INCREASE IN COTTON RESISTANCE TO WATER SHORTAGE BY DISPERSION OF COPOLYMER-VINYL-ACETATE,
Institute for Plant Protection, Belgrade (Yugoslavia); and Federal Inst. of Hydrometeorology, Belgrade (Yugoslavia); and Belgrade Univ. (Yugoslavia). School of Agriculture.
For primary bibliographic entry see Field 03F.
W72-03697

ECONOMIC FEASIBILITY OF INCREASING PECOS BASIN WATER SUPPLIES THROUGH REDUCTION OF EVAPORATION AND EVAPOTRANSPIRATION,
New Mexico Univ., Albuquerque. Dept. of Economics.
For primary bibliographic entry see Field 03B.
W72-03768

EFFECT OF STAGE OF GROWTH OF COWPEAS ON EVAPO-TRANSPIRATION RATES BY THE CROP,
College of Agriculture, New Delhi (India).
For primary bibliographic entry see Field 03F.
W72-03804

AN INSULATED EVAPORIMETER,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W72-03878

EFFECT OF THERMAL STRATIFICATION OF THE AIR LAYER NEAR THE WATER ON THE EVAPORATION RATE (VLIYANIYE TEMPERATURNOY STRATIFIKATSII PRIVODNOGO SLOYA ATMOSFERY NA SKOROST' ISPARENIYA),
State Oceanographic Inst., Moscow (USSR).
N. P. Goptarev, and G. N. Panin.
In: Gidrologiya i gidrokhimiya morey i ust'yev rek; Gosudarstvennyy Okeanograficheskiy Institut Trudy, No 98, p 148-155, 1970. 1 fig, 5 tab, 8 ref.

Descriptors: *Evaporation, *Thermal stratification, *Atmosphere, Water balance, Water temperature, Air temperature, Humidity, Vapor pressure, Wind velocity, Turbulence, Equilibrium, Seasonal, Equations.
Identifiers: *USSR, Caspian Sea, Water surface.

As evidenced from an analysis of average long-term monthly values of evaporation from the surface of the Caspian Sea, thermal stratification of the atmosphere has a distinct effect on average long-term seasonal evaporation. Evaporation values are 6-10% higher during the cold period of the year and 6-10% lower during the warm period than for equilibrium stratification. An approximate evaluation is given of the applicability of semiempirical equations developed to estimate evapora-

tion. These equations require modification, particularly in regard to refining experimental parameters. Working formulas and tables are presented for estimating evaporation by the exponential and power method. The exponential method provides fairly reliable results and may be used for approximate estimate of the effects of thermal stratification on the evaporation rate. The power method can be used only for near-equilibrium temperature conditions. (Josefson-USGS)
W72-03894

WAX DIP FOR TOMATO TRANSPLANTS,
Delaware Univ., Newark. Dept. of Plant Science.
For primary bibliographic entry see Field 03F.
W72-03997

AN EXPERIMENTAL STUDY OF EDDY DIFFUSION COEFFICIENTS, EVAPOTRANSPIRATION AND WATER USE EFFICIENCY,
Illinois Univ., Urbana. Water Resources Center.
R. J. Millington, and D. B. Peters.
Available from the National Technical Information Service as PB-206 304, $3.00 in paper copy, $0.95 in microfiche. Illinois Water Resources Center, Urbana, Research Report No 48, December 1971. 15 p, 5 ref. OWRR A-031-ILL (8).

Descriptors: *Evapotranspiration, *Mass transfer, Photosynthesis, Crops.
Identifiers: Energy balances.

Measurements of mass transfer coefficients were made directly by the use of point and line sources. The gas used was propane. The studies revealed that the form of the profile of mass transfer coefficients was markedly dependent on crop geometry, with a local maximum and minimum within the crop canopy. Further studies demonstrated the anisotropy of mass transfer coefficients above the crop canopy wherein the downwind component was greater than the crosswind component. Crosswind and vertical components were nearly equal. Studies were also made on energy balances within crops and with individual plant leaves.
W72-04083

2E. Streamflow and Runoff

ARTIFICIAL RECHARGE OF STORM RUNOFF AT KAHLUI, MAUI,
Hawaii Univ., Honolulu.
For primary bibliographic entry see Field 04B.
W72-03529

ROLE OF BASEFLOW IN RAINFALL-RUNOFF RELATIONS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 02A.
W72-03570

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 3. OHIO RIVER BASIN-VOLUME 1, OHIO RIVER ABOVE KANAWHA RIVER.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-03609

TIME AND FREQUENCY-DOMAIN IDENTIFICATION OF A CAUSAL BIVARIATE STOCHASTIC PROCESS,
Arizona Univ., Tucson. Dept. of Hydrology; and Arizona Univ., Tucson. Dept. of Systems Engineering.
For primary bibliographic entry see Field 06A.
W72-03677

STOCHASTIC ANALYSIS OF EPHEMERAL FLOW IN ARID LANDS,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 02A.
W72-03678

THE FEASIBILITY OF AUGMENTING HYDROLOGIC RECORDS USING TREE-RING DATA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 07B.
W72-03691

MANAGEMENT ALTERNATIVES IN THE USE OF THE WATER RESOURCES OF THE PECOS RIVER BASIN IN NEW MEXICO,
New Mexico State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06A.
W72-03771

WIND SHEAR-TURBULENCE AND REAERATION COEFFICIENT,
Williams (Clyde E.) and Associates, Inc., South Bend, Ind.
For primary bibliographic entry see Field 08B.
W72-03841

CUBIC INTERPOLATION FOR NUMERICAL FLOOD ROUTING,
Turner, Collie and Braden Co., Inc., Houston, Tex.
P. E. Barker, and T. P. Propson.
ASCE Proceedings, Journal of Hydraulics Division, Vol 98, No HY1, p 309-314, January 1972. 3 fig, 3 ref, append.

Descriptors: *Flood routing, *Data processing, *Computer programs, Stage-discharge relations, Flood forecasting.
Identifiers: Data interpolation.

The accessibility of digital computers to the water resources engineer has boosted the popularity of numerical flood routing techniques. Common to each of the numerical solutions is the need to interpolate between known values of two variable functions. Data for head versus discharge and head versus area (or capacity), if plotted, are generally well-behaved, having a continuously positive or negative first derivative. A parabolic interpolation technique is accurate in generating a solution from this type of data; however, the parabolic interpolation technique was not as successful in defining the inflection points of an inflow hydrograph as was desired. For this reason, a cubic interpolation technique was devised. The cubic interpolation technique is an accurate method in determining intermediate values in a data array that has inflections. The technique can be reduced to a few Fortran statements and used efficiently as a function subprogram in flood routing. (Knapp-USGS)
W72-03843

GRADUALLY VARYING TWO-LAYER STRATIFIED FLOW,
Technical Univ. of Denmark, Copenhagen. Inst. of Hydrodynamics and Hydraulic Engineering.
F. B. Pederson.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 98, No HY1, Paper 8679, p 257-268, January 1972. 9 fig, 2 ref, append.

Descriptors: *Stratified flow, *Saline water intrusion, *Density stratification, *Fjords, *Estuaries, Mixing, Shear stress, Dispersion, Diffusion, Path of pollutants, Froude number, Sea water, Currents (Water), Water circulation, Tides, Tidal effects, Fluid friction.

The basic concepts and equations of stratified flow are applied to circulation in fiords. The mechanism of entrainment is a one-way transport process from the nonturbulent layer. With the use of the momentum and work energy equations, both with respect to the net entrainment, the dimensionless entrainment is found to be equal to the friction coefficient. The general shape of the shear stress distribution is outlined and differential equations are found for the depth and density variations of a layer of brackish water flowing over a pool of salt water. The general equations are given for a gradually varying width. (Knapp-USGS)
W72-03845

STREAMLINES IN TWO-DIMENSIONAL LAMINAR BRANCH FLOWS,
Papua and New Guinea Univ., Port Moresby. (New Guinea).
For primary bibliographic entry see Field 08B.
W72-03846

TWO-DISTRIBUTION METHOD FOR FLOOD FREQUENCY ANALYSIS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 04A.
W72-03848

SPATIALLY VARIED FLOW OVER SIDE--WEIRS,
Indian Inst. of Tech., Kanpur. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W72-03849

FLOW OF LAYERED FLUID OVER BROAD CRESTED WEIR,
Canterbury Univ., Christchurch (New Zealand). Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W72-03850

SEASONAL OCCURRENCE OF ANNUAL FLOODS ON SMALL PENNSYLVANIA WATERSHEDS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
B. M. Reich.
Water Resources Bulletin, Vol 7, No 6, p 1153-1171, December 1971. 13 fig, 2 tab, 8 ref.

Descriptors: *Floods, *Pennsylvania, *Peak discharge, *Statistics, Data collections, Flood forecasting, Land use, Rainfall-runoff relationships, Probability, Small watersheds.

Instantaneous annual maximum discharges from 66 watersheds in Pennsylvania were analyzed using 2,052 flood values measured on areas ranging from 2.4 through 214 square miles. The longest record was 60 years; the three shortest were 20. The number of floods for each month and individual discharges were correlated with the mean flood. Both the incidence and the magnitude of floods are shown by a weighted parameter. Peculiarities of flood-timing charts based on this parameter are discussed with respect to watershed size, soils, geology, and land use. Flood-timing charts from most records exhibit a regional dichotomy dividing eastern from western Pennsylvania. (Knapp-USGS)
W72-03875

SELECTION OF A METHOD FOR CALCULATING DISTRIBUTION OF WATER DISCHARGES IN DELTA ARMS (VYBOR METODA RASCHETA RASPREDELENIYA RASKHODOV VODY PO RUKAVAM DEL'T),
State Oceanographic Inst., Moscow (USSR).
T. A. Makarova.
In: Gidrologiya i gidrokhimiya morey i ust'yev rek; Gosudarstvennyy Okeanograficheskiy Institut Trudy, No 98, p 23-28, 1970. 12 ref.

Descriptors: *Discharge (Water), *Water levels, *Stage-discharge relations, *Deltas, *Measurement, Hydrometry, Hydraulics, Cross-sections, Slopes, Velocity, Depth, Width, Roughness coefficient, Equations.

Identifiers: *USSR, Danube River.

Two methods of computing distribution of water discharges in delta arms of the Danube River are described: (1) the hydrometric method, which employs direct measurements and takes into account the hydrologic regime of an estuary (runoff phase and magnitude, periodicity of sea level fluctuations, etc); and (2) the hydraulic method, which gives an approximate picture of the distribution of water discharges on the basis of limited observational data. When observational data are fairly complete, the hydrometric method is preferred, using synchronous discharge curves for an unstable regime and the discharge relation Q=f (H) for steady flow conditions. The hydraulic method may be used for approximate computations in preliminary stages of planning and especially for deriving the spatial characteristics of water levels and flow distribution in delta arms. (Josefson-USGS)
W72-03896

FLOOD OF MARCH 1968 ON THE CHARLES RIVER, MASSACHUSETTS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-03903

FLOODS ON ROCK RIVER IN SOUTHWESTERN JEFFERSON COUNTY, WISCONSIN,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-03904

HYDROLOGY OF THE GENESEE RIVER BASIN, NEW YORK AND PENNSYLVANIA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-03906

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 5. HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS, VOLUME 1. HUDSON BAY BASIN.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07B.
W72-03908

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 5. HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS, VOLUME 2, UPPER MISSISSIPPI RIVER BASIN ABOVE KEOKUK, IOWA.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-03909

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 4. ST. LAWRENCE RIVER BASIN, VOLUME 1. BASINS OF STREAMS TRIBUTARY TO LAKES SUPERIOR, MICHIGAN, AND HURON.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-03910

STUDIES IN DOUBLE ASYMPTOTICS AND STRATIFIED FLUID FLOW,
Wisconsin Univ., Madison. Dept. of Mathematics.
D. D. Freund.
Ph.D. Thesis, Wisconsin Water Resources Center, Madison, 1972. 121 p, 8 fig, 2 tab, 30 ref, 8 append. OWRR A-037-WIS (2).

Descriptors: *Waves (Water), *Erosion, *Currents (Water), *Diffusion, *Viscosity, *Flow, Streamflow, Reynolds number, Froude number.
Identifiers: *Wake, *Two-dimensional flow, *Asymptotics, Kaplun's Extension Theorem.

Part I--The two-dimensional flow induced by a body of relatively large thickness moving horizontally at constant speed U through a stably stratified fluid is treated. The previous attempts to describe this motion are refuted, and the key assumptions of small Reynolds number and negligible diffusion shown to be erroneous. The effects of diffusion (of salt in the laboratory, and of heat in the atmosphere) are considered, and the appropriate auxiliary conditions are found, leading to the formulation of the problem as a singular integral equation. This is solved explicitly, yielding a first-order approximation to the flow field both upstream and downstream of the body. The approximation predicts the existence of blocking columns ahead of and behind the body, which at great distances are eroded by viscosity and diffusion. The wake far upstream and downstream eventually assumes the similarity form presented by Long in 1962. The differential equations describing this diffusive wake are solved explicitly in terms of Airy functions. The representation of the flow field is found to be an approximate solution of the full governing equations valid in essentially the limit of large stratification scale and small body Froude number. In particular, the Reynolds number can be large, so that the flow is slow in the sense of small Froude number rather than small Reynolds number. Part II--The foundation of 'inner-outer' expansions and allied methods is examined. Two limit definitions (both yielding Kaplun's Extension Theorem) are compared in regard to double limit asymptotics.
W72-03991

WAVE TRAIN DIRECTION ANALYSIS,
Chicago Bridge and Iron Co., Plainfield, Ill. Marine Research and Development.
S. K. Chakrabarti.
ASCE Proceedings, Journal of the Waterways, Harbors and Coastal Engineering Division, Vol 97, No WW 4, p 787-792, Nov 1971. 1 fig, 1 tab, 12 ref, append.

Descriptors: *Waves (Water), *Instrumentation, *Profiles, Frequency analysis, Hydraulic models, Ocean waves, Refraction (Water waves), Wavelengths, Analytical techniques.
Identifiers: *Wave direction.

New methods are given for finding the directional spectrum of ocean waves. Three or more wave staffs are used near the water surface to record the wave profile. The calculation is simplified if all the spacings are less than the wavelength of the smallest frequency expected. The records are taken simultaneously at all staffs. These records are then analyzed to obtain the wave height and direction for that time span. To prove the validity of the method, a test was set up with known wave periods and wave direction. From the wave profiles obtained by four wave probes placed at random near the water surface, an average wave direction was calculated. In all the cases tested, it was found that the wave direction may be predicted within reasonable limits. (Knapp-USGS)
W72-04023

ESTIMATION OF WAVE PARAMETERS AT MARINE CONSTRUCTION,
Institute of Sea Transport, Moscow (USSR). State Research Project.
For primary bibliographic entry see Field 08B.
W72-04024

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 15. ALASKA.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-04038

NUMERICAL STUDIES OF UNSTEADY FLOW IN THE JAMES RIVER,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
D. N. Contractor, and J. M. Wiggert.
Available from the National Technical Information Service as PB-206 305, $3.00 in paper copy, $0.95 in microfiche. Virginia Water Resources Research Center, Blacksburg, Completion Report September 1971. 51 p, 22 fig, 3 tab, 6 ref. OWRR A-036-VA (3).

Descriptors: *Flood routing, *Numerical analysis, *Computers, *Open channel flow, *Reservoir stages, *Low flow, River flow, Hydraulics, Roughness (Hydraulic), Flood, Virginia.
Identifiers: James River (Va), Smith Mountain Pump Storage Project (Va), Leesville Reservoir (Va).

The implicit method of solution of the continuity and momentum equations of flow in open channels was used to study problems of unsteady flow in natural rivers. A computer program was written to obtain solutions along the river with appropriate boundary conditions. The first problem relates to flood flows in the James River. A storm in December 1967 was analyzed and the comparison between the computed and measured flows was good. The second problem relates to the study of low flows from Holcomb's Rock, Virginia to Bent Creek, Virginia in the James River. Attempts to model these flows showed that the program in single precision was unstable. However, when the same program was run in double precision, good agreement was obtained between measured and computed flows. The last problem was the analysis of waves in a pump-storage reservoir. Data was obtained on flows in Leesville Reservoir, on the Roanoke River, Virginia. The computer program was used to calculate reservoir levels and good agreement was obtained between measured and computed levels, indicating that this method could be used to study waves of long wavelength in reservoirs.
W72-04084

A COMPILATION OF FLOOD ABATEMENT PROJECTS IN OREGON,
Oregon State Univ., Corvallis. Water Resources Research Inst.
For primary bibliographic entry see Field 04D.
W72-04093

PREDICTION OF SEASONAL-LOW STREAMFLOW, QUANTITIES,
Oregon State Univ., Corvallis. Water Resources Research Inst.
J. C. Campbell.
Available from the National Technical Information Service as PB-206 229, $3.00 in paper copy, $0.95 in microfiche. Publication WRRI-10, September 1971. 16 p, 10 tab. OWRR A-001-ORE (11).

Descriptors: *Low-flow, *Hydrologic budget, *Streamflow, *Droughts, *Streamflow forecasting, Distribution patterns, Water supply.

An attempt was made to understand the hydrologic characteristics of streamflow under dry weather conditions and to develop from this knowledge some means for prediction of seasonal-low streamflow quantities. 'Drought frequency plots' for a number of watersheds of varying sizes and regions of the country were prepared. A 'Probability Graph' was developed for the prediction of watershed low-flow yield based on typical streamflow records. This graph predicts 'low-flow water yield', using the parameters of 'median value of 9 or more consecutive years of low-flow data' and 'selected recurrence interval'. It is a simplified approach to low-flow predictions which does not take into account directly the many variables of watershed cover, soil types, steepness of terrain, climatic conditions, habitation, etc. Even so, a surprising accuracy of predition is indicated.
W72-04094

2F. Groundwater

DYNAMIC PROGRAMMING MODEL AND QUANTITATIVE ANALYSIS, ROSWELL BASIN, NEW MEXICO,
New Mexico Inst. of Mining and Technology, Socorro. Hydrology Section.
Z. A. Saleem, and C. E. Jacob.
Available from the National Technical Information Service as PB-206 188, $3.00 in paper copy, $0.95 in microfiche. New Mexico Water Resources Research Institute, La Cruces, WRRI, Report No. 10, 1971. 180 p, 41 fig, 54 tab, 85 ref, 5 append. OWRR B-006-NMEX (4) and B-011-NMEX (4).

Descriptors: *Dynamic programming, *Mathematical model, *Aquifers, *New Mexico, Hydrology, Hydrogeology, Recharge, *Leakage, Groundwater recharge, Aquifer characteristics, Hydrologic budget, Water level fluctuations, Hydrologic conductivity, Natural recharge, Conjunctive use, Surface-groundwater relationships, *River basins, Groundwater basins, Encroachment, Saline water intrusion.
Identifiers: *Coupled leaky aquifers, *Interaquifer leakage, Natural discharge, Alluvium, Pecos River Basin, *Roswell Basin (NMex).

This report is concerned with the optimal utilization of a composite system of interacting aquifers in which one aquifer leaks into another, and with a surface-water sub-system from the viewpoint of maximizing the value added to the system by operation of a system over a long period of time. The problem is solved through dynamic programming, a sequential decision-making approach. Stochastic recharges, base flow, and natural discharge from the system are considered in addition to the interaquifer leakage. The model developed was applied to the coupled leaky aquifer and surface-water system of the Roswell Basin which forms part of the Pecos River Basin in New Mexico. A hydrologic analysis of the basin was also performed and the results were fed into the dynamic-programming model as input. The optimal operating policies for the two aquifers of the Roswell Basin were derived by taking into consideration the physical characteristics of the system and the extent of the areas to be irrigated with water drawn from the system. The optimal operating policies are strongly influenced by the interaquifer leakage. As a result, coupled leaky aquifers should be considered for conjunctive utilization only. (Creel-New Mexico)
W72-03770

MANAGEMENT ALTERNATIVES IN THE USE OF THE WATER RESOURCES OF THE PECOS RIVER BASIN IN NEW MEXICO,
New Mexico State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06A.
W72-03771

GROUND-WATER AND GEOHYDROLOGIC CONDITIONS IN QUEENS COUNTY, LONG ISLAND, NEW YORK,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04B.
W72-03857

EFFECTS OF KARST FEATURES ON CIRCULATION OF WATER IN CARBONATE ROCKS IN COASTAL AREAS,
Geological Survey, Washington, D.C.
V. T. Stringfield, and H. E. LeGrand.
Journal of Hydrology, Vol 14, No 2, p 139-157, November 1971. 6 fig, 25 ref.

Descriptors: *Hydrogeology, *Karst, *Groundwater movement, *Water chemistry, *Saline water intrusion, Water circulation, Aquifer characteristics, International Hydrological Decade, Discharge (Water), Recharge, Permeability, Water level fluctuations.
Identifiers: *Coastal aquifers.

The normal balance between fresh water in coastal aquifers and sea water applies also to carbonate-rock aquifers, but there are local modifications in the balance to be considered. Uneven distribution of permeability in a network of solution channels bounded by relatively impermeable rock, causes an uneven distribution of head along the seacoast. Where sinkholes or vertical solution shafts below sea level penetrate the aquifer, the fresh groundwater may discharge through these karst features if the fresh-water head is greater than that of the salt water. However, under some conditions the salt-water head may exceed that of the fresh water, and the direction of movement is reversed as sea water flows into the aquifer. Integrated evaluations of (1) the distribution of permeability in coastal karst regions and (2) the principles relating to the dynamic balance between fresh aquifer water and sea water are leading to better knowledge of methods that may salvage much karst water which is lost to the sea. (Knapp-USGS)
W72-03864

ANALYSIS OF GROUNDWATER FLOW TO DEEP WELLS IN AREAS WITH A NON-LINEAR FUNCTION FOR THE SUBSURFACE DRAINAGE,
Institute for Land and Water Management Research, Wageningen (Netherlands).
L. F. Ernst.
Journal of Hydrology, Vol 14, No 2, p 158-180, November 1971. 11 fig, 23 ref.

Descriptors: *Drawdown, *Water level fluctuations, *Infiltration, *Groundwater movement, *Withdrawal, Water wells, Water yield, Transmissivity, Flow, Aquifer characteristics, Water level fluctuations, Water table.

Quantitative analysis of groundwater flow to deep wells in areas where the excess precipitation is discharged largely by surface infiltration requires information about the system of surface drainage. The nonlinear relation between the discharge and the phreatic level can be explained by the fact that the length of the drains varies in the same sense as the discharge and the phreatic level. There is some evidence that the amplitude of the seasonal fluctuations of the phreatic surface will not be influenced very much when there is a constant pumping of water from deep wells. When the relation between hydraulic head and discharge by drains is linearized, the basic differential equation is reduced to a Bessel equation of zero order. (Knapp-USGS)
W72-03865

SEASONAL FLUCTUATIONS IN THE CHEMISTRY OF LIMESTONE SPRINGS: A POSSIBLE MEANS FOR CHARACTERIZING CARBONATE AQUIFERS,
Pennsylvania State Univ., University Park. Dept of Geochemistry and Mineralogy; and Pennsylvania State Univ., University Park. Materials Research Lab.
For primary bibliographic entry see Field 02K.
W72-03867

BEACHES AND GROUND WATER OF CAPE SABLE, FLORIDA, DURING EXTREME DROUGHT,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 02L.
W72-03872

GEOLOGY AND GROUNDWATER CONDITIONS OF PARTS OF NAINITAL DISTRICT, UTTAR PRADESH,
Geological Survey of India, Calcutta.
For primary bibliographic entry see Field 04B.
W72-03879

SUBSURFACE FLOW INTO THE CASPIAN SEA (O PODZEMNOM STOKE VODY V KASPIYSKOM MORE),
State Oceanographic Inst., Moscow (USSR).
M. S. Potaychuk.
In: Gidrologiya i gidrokhimiya morey i ust'yev rek; Gosudarstvennyy Okeanograficheskiy Institut Trudy, No 98, p 165-173, 1970. 2 fig, 2 tab, 14 ref.

Descriptors: *Subsurface flow, *Subsurface runoff, *Subsurface drainage, *Groundwater, *Confined water, Water balance, Water chemistry, Water quality, Salinity, Salts, Brackish water, Saline water, Brines, Fresh water, Hydrogeology, Aquifers, Maps.
Identifiers: *USSR, *Caspian Sea, *Artesian basins, Mineralization.

The extent of subsurface flow into the Caspian Sea and the chemical composition of groundwaters in various coastal areas were studied in connection with the present and future water balance of the sea. Subsurface discharge was computed taking into account orographic, climatic, hydrographic, and geologic conditions. Groundwaters draining directly into the sea, alluvial waters flowing into the sea from rivers, and artesian waters discharging in coastal areas and in the sea were determined. Total discharge of alluvial waters and groundwaters from the coast is small and amounts of 1 cu km/yr. Artesian waters contribute substantially to the subsurface water supply to the sea and amount to about 3 cu km/yr. Two maps of the Caspian Sea are examined: (1) a map of artesian basins and artesian-water discharge, outlining boundaries of artesian basins, regions of water under pressure, regions where presence of artesian waters is supported by factual data, regions of drainage, regions of presumed artesian-water drainage, and direction of artesian waters; and (2) a map of groundwater mineralization, indicating fresh waters (50-100 mg/liter), brackish waters (1-2 g/liter), saline waters (3-10 g/liter), highly mineralized waters (11-30 g/liter), and brines (31-450 g/liter). (Josefson-USGS)
W72-03900

HYDROGEOLOGY OF THE PINE RIDGE INDIAN RESERVATION,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-03905

HYDROLOGY OF THE ROSEBUD INDIAN RESERVATION, SOUTH DAKOTA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-03907

COMPUTER AND PHYSICAL MODELS FOR SOLVING SUBSURFACE PROBLEMS IN HYDROLOGY,
Wisconsin Univ., Madison, Water Resources Center.
G. M. Karadi, and G. L. Roderick.
Available from the National Technical Information Service as PB-206 141, $3.00 in paper copy, $0.95 in microfiche. Wisconsin Water Resources Center, Madison, Completion Report, 1971. 64 p, 34 fig, 8 ref. OWRR A-029-WIS (2).

Descriptors: *Infiltration, Groundwater, *Groundwater movement, *Groundwater barriers, *Porosity, *Surface-groundwater relationships, Dupuit-Forcheimer theory, Water wells, Phreatic lines, Transmissivity, Analytical techniques, Laboratory testing, Seepage, Drainage effects, *Model studies, *Computer models.
Identifiers: *Conformal mapping technique, Semi-infinite seepage domain.

The report discusses and evaluates different approaches to solving transient groundwater-flow problems associated with the two-dimensional drainage of a phreatic aquifer in a homogeneous

isotropic soil, presents a new method to describe the transient flow under these conditions, and describes the experimental techniques used to evaluate the analytic solutions. Exact analytical treatment of the problem of groundwater flow toward tile drains or trenches is difficult because of the complicated non-linear boundary condition on the free surface. Based on the conformal mapping technique proposed by Kalinin, the cases of a single drain, two parallel drains, and periodic drains were considered under the assumption of a semi-infinite solution domain. The results indicate that solutions based on the Dupuit-Forcheimer assumption produce highly unrealistic results, even for use as rough approximations. The applicability of the analytic technique is limited to relatively small values of the time parameter, T less than 1.5, and to semi-infinite seepage domain. The conformal mapping technique cannot be used for more complex situations. Because the methods based on the Dupuit-Forcheimer assumption are unreliable, a new approach is suggested whereby successive changes of steady-state conditions are used. The comparison of calculated and experimental data indicate that the proposed technique is highly accurate and provides stable solutions regardless of the complexity of the boundary conditions.
W72-03990

HYDROLOGY, GEOLOGY AND EROSION BY LEACHING IN SKILLMAN BASIN ON THE WESTERN HIGHLAND RIM, LAWRENCE COUNTY, TENNESSEE,
Vanderbilt Univ., Nashville, Tenn. Dept. of Geology.
For primary bibliographic entry see Field 02J.
W72-04020

PLEISTOCENE AND RECENT CHANNEL SEEPAGE FLATS IN NORTH-CENTRAL TEXAS,
Texas Tech Univ., Lubbock. Dept. of Geosciences.
C. C. Reeves, Jr., and D. W. Reeves.
Geological Society of America Bulletin, Vol 82, No 12, p 3511-3518, December 1971. 10 fig, 1 tab, 10 ref.

Descriptors: *Seepage, *Flood plains, *Springs, *Brines, *Texas, Salts, Saline water, Sedimentation, Erosion.
Identifiers: *Salt flats.

'Salt flats' of north-central Texas are local erosional flood plains (hydrologic) formed in an area of youthful topography. Development initially depends on establishment of a local base level by a wet impermeable stratigraphic lens overlain by soft, dry silts, sands and clays. Groundwater flowing laterally along the bottom and top of the resistant lens escapes by springs and seeps where the lens is intersected by stream valleys. This causes undercutting and slumping of overlying soft, dry materials which are removed from the valley by sheet wash during wet periods. Thus, the valley is widened laterally but the intermittent stream is unable to entrench below the base level established by the perennially wet sediments. The term 'channel seepage flat' is suggested because development does not depend on corrosion by lateral stream action. (Knapp-USGS)
W72-04050

2G. Water in Soils

SOIL MANAGEMENT: HUMID VERSUS ARID AREAS,
Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils.
For primary bibliographic entry see Field 03F.
W72-03665

SOME SOIL AGE-RANGE VEGETATION RELATIONSHIPS,
South Dakota State Univ., Brookings. Dept. of Plant Science.
For primary bibliographic entry see Field 04A.
W72-03715

RECLAMATION OF THE BRACK ALLUVIAL SOILS OF RIET RIVER USING THE THRESHOLD CONCENTRATION CONCEPT,
Agricultural Research Inst., Glen (South Africa).
A. J. Van Der Merwe.
Agrochemophysica. 1 (2): 67-72. Illus. 1969. African and French summaries.
Identifiers: Africa, Alluvial, Brack, Concentration, Excessive, Exchangeable, Irrigation, Leaching, Reclamation, Riet, River, Salt, Sodium, Soils, South, Threshold.

The saline-alkali soils with an exchangeable sodium percentage (ESP) of 33 could be reclaimed within 46 days to a depth of 4 ft using 78 tons of gypsum, 113 tons of NaCl/morgen and an irrigation of 250 in. A maximum infiltration rate of 0.21 in./hr was maintained by dissolving the gypsum and NaCl in the irrigation water, observing the threshold concentration concept. Irrespective of the high irrigation, the large amount of gypsum and NaCl required makes reclamation uneconomical. The only advantage of this method over the conventional gypsum and S methods is that reclamation can be accomplished within 46 days in comparison with 10 yr. When only gypsum is dissolved in the irrigation water, at a rate of 15 me/l, only 18 of the calculated 71 tons of gypsum/morgen could be applied in 48 days due to a slow infiltration rate. The infiltration rate of the soil during this reclamation process was only 0.04 in/hr. Using 0.1 in./hr as a satisfactory infiltration rate during reclamation, the level of electrolyte concentration needed for a not more than 50% decrease in permeability can be redefined for different ESP values for these soils. These soils can in most cases be successfully reclaimed with water from the Modder, Riet River and borehole water of that area, depending on the Na adsorption ratios and electrolyte concentration of the water, and the ESP of the soil on which the water will be used. No amendments are required and the only prerequisite is enough reclamation water and an additional irrigation with Kalkfontein dam water to leach excessive salts which may be harmful to crops.--Copyright 1971, Biological Abstracts, Inc.
W72-03806

THE MOBILITY OF PHOSPHORUS, POTASSIUM, AND CALCIUM IN A FOREST SOIL,
Washington Univ., Seattle. Coll. of Forest Resources.
For primary bibliographic entry see Field 05B.
W72-03825

THE CAUSE OF THE SUSPENSION EFFECT IN RESIN-WATER SYSTEMS,
Montana State Univ., Bozeman. Dept. of Chemistry.
R. A. Olsen, and J. E. Robbins.
Soil Sci Soc Amer Proc. 35 (2): 260-265. Illus. 1971.
Identifiers: Junction, Potential, Resin, Suspension, Systems.

The traditional hypothesis attributes the effect to a different activity of ions in the suspension than in the dialyzate. The alternative hypothesis attributes the effect largely to a junction potential at the calomel-suspension boundary; this hypothesis is correct. Activities of chloride ions cannot be reliably measured directly in resin-water systems due to the uncertainty of a junction potential which may be negligibly small or may be as high as several hundred mv. Osmotic pressure and freezing point determinations provided confirmatory evidence that the activity of ions was virtually identical in slurry and dialyzate even though the suspension effect was exceptionally large.--Copyright 1971, Biological Abstracts, Inc.
W72-03827

CHARGE LOCATION AS A FACTOR IN THE DEHYDRATION OF 2:1 CLAY MINERALS,
California Univ., Berkeley. Dept. of Soils and Plant Nutrition.
H. E. Doner, and M. M. Mortland.
Soil Sci Soc Amer Proc. 35 (2): 360-362. Illus. 1971.
Identifiers: Charge, Clay, Dehydration, Factor, Location, Minerals.

Water was removed from Cu (II)-saturated smectites by methanol when the isomorphic substitution was in the octahedral layer. However, Cu (II)-saturated tetrahedrally charged smectites and vermiculites were not completely dehydrated by this treatment. Similarly, when (CH3)4N+-smectites and vermiculites were degrassed, only those clays octahedrally charged were dehydrated. Deuteration of (CH3)4N-montmorillonite and saponite showed the OD stretching frequency for D2O bonded to the silica surface was at a higher frequency for montmorillonite than saponite, indicating a stronger deuterium bond to the surface O2 for the latter clay. Water was bonded with greater energy to tetrahedrally charged clays, possibly resulting from their more localized charge on the silicate surface.--Copyright 1971, Biological Abstracts, Inc.
W72-03835

FIELD MEASUREMENTS OF UNSATURATED HYDRAULIC CONDUCTIVITY BY INFILTRATION THROUGH ARTIFICIAL CRUSTS,
Wisconsin Geological and Natural History Survey, Madison.
J. Bouma, D. I. Hillel, F. D. Hole, and C. R. Amerman.
Soil Sci Soc Amer Proc. 35 (2): 362-364. Illus. 1971.
Identifiers: Artificial, Conductivity, Crusts, Field, Hydraulic, Infiltration, Matric, Measurement, Moisture, Soil, Suctions, Tensiometer, Unsaturated.

Field trials were made to test the applicability of a proposed method for measurement in a 1-dimensional flow system, where the matric suction gradient is 0. K-values were determined from infiltration rates into crust-capped soil columns carved out in situ 30 cm in height. Matric suctions were measured with tensiometers. Examples are given for 4 Wisconsin soil horizons.--Copyright 1971, Biological Abstracts, Inc.
W72-03836

CONTEMPORARY SOIL WEDGE FORMATION IN WESTERN SOUTH DAKOTA,
South Dakota State Univ., Brookings. Dept. of Plant Science.
E. M. White.
Soil Sci Soc Amer Proc. 35 (2): 306-309. Illus. 1971.
Identifiers: Formation, Patterns, Soil, South-Dakota, Sub, Wedge, Western.

Subsoil wedges, ranging from narrow, dark-colored infusions of surface soil between prisms to V-shaped clay or light-colored sandy wedges more than 1 m across, occur in some semi-arid soils. Light-colored wedges usually form in gravelly subsoils. A proposed explanation of how the wedges form is: surface material falls downward into narrow subsoil desiccation cracks, in subsequent cycles of rewetting the dry soil, water drains more rapidly into the wedge than into the enclosing soils so the wedge swells first and closes the desiccation cracks in the adjacent dry soil, the wedge widens more at the top to form a V-shape because the moisture content changes frequently near the soil surface and growth ceases when individual sand grains in the wedge are bridged by clay to form stable peds or the V-shape becomes sufficiently wide so water flows down along the inclined wedge boundary and wets and swells the enclosing soil as rapidly as the center of the wedge.--Copyright 1971, Biological Abstracts, Inc.
W72-03837

CANFIELD SILT LOAM, AND FRAGIUDALF: I. MACROMORPHOLOGICAL, PHYSICAL, AND CHEMICAL PROPERTIES,
Ohio State Univ., Columbus. Dept. of Agronomy.
F. P. Miller, N. Holowaychuk, and L. P. Wilding.
Soil Sci Soc Amer Proc. 35 (2): 319-324. Illus. Map. 1971.
Identifiers: Argillans, Bisequal, Canfield, Chemical, Fragipan, Fragiudalf, Loam, Macro, Management, Morphological, Physical, Profile, Runoff, Silt, Soil, Strontium-90, Subsurface.

These fragipan soils derived from low-lime glacial till are intensively used for both agricultural and urban purposes. Because this soil is being used for a long-term study of the disposition of strontium-90 under natural conditions and because of its classification was unconfirmed, 18 profiles from the Ohio Agricultural Research and Development Center at Wooster were described and characterized. The soil profile tended to be bisequal with a moderately well-developed, loam fragipan occurring at an average depth of 45 cm. The bulk density of the fragipan centered on 1.7, with coarse fragments occupying about 12-16% by volume. The Canfield series was found to contain an argillic horizon above the fragipan and was classed as an Aquic Fragiudalf assigned to the fine-loamy, mixed, mesic family. The fragipan controls the hydraulic conductivity of this soil, resulting in lateral-movement of percolating water across the fragipan surface equivalent to about 30% of the total precipitation. The quantity of subsurface runoff which must accrue from the long slopes, which sometimes exceed 300 m, poses a major problem for the use and management of this soil.--Copyright 1971, Biological Abstracts, Inc.
W72-03839

METAL IONS INTERACTION WITH SOILS OF DIFFERENT GENESIS AND PHYSICAL AND CHEMICAL PROPERTIES,
Tuskegee Inst., Alabama. Dept. of Agronomy.
W. G. Fleming.
M Sc Thesis, May 1971. 48 p, 9 fig, 9 tab, 55 ref, append. OWRR B-028-ALA (2).

Descriptors: *Soil water movement, *Soil properties, *Ion transport, *Groundwater, *Surface waters, Ionization, Chemical reactions, Cation, Adsorption, Metals, Testing, Analytical techniques, Hydrogen ion concentration, Water chemistry.

The movement of metal ions through soil was studied concerning ion occurrence in surface water and groundwater. Properties of the soil that influence the extent of this movement in and through the soil are identified. Four soils of different genetic conditions were used in the tests. A zinc adsorption and displacement study was conducted to simulate the movement of metal ions, and their occurrence in the soil. Zinc was added to 1 gram of soil in concentrations from 0.1 to 0.8 meq per 10 mls of solution at pH 5.8. Zinc was adsorbed by the soil in three forms: exchangeable, chelated, and nondisplaceable. Factors affecting the adsorption of metal ions included pH, cation exchange capacity, organic matter content, and texture of the soil. Higher concentrations of metal ions were found in groundwater than in surface water. Clay and silt soil with high organic matter content and high cation exchange capacity, and of low pH had a higher adsorption of metal ion than sandy soil with low organic matter content and low cation exchange capacity. (Woodard-USGS)
W72-03840

ANALYSIS OF GROUNDWATER FLOW TO DEEP WELLS IN AREAS WITH A NON--LINEAR FUNCTION FOR THE SUBSURFACE DRAINAGE,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 02F.
W72-03865

SOME PROPERTIES OF FLOWS IN UNSATURATED SOILS WITH AN EXPONENTIAL DEPENDENCE OF THE HYDRAULIC CONDUCTIVITY UPON THE PRESSURE HEAD,
Johns Hopkins Univ., Baltimore, Md.
P. A. C. Raats.
Journal of Hydrology, Vol 14, No 2, p 129-138, November 1971. 1 fig, 21 ref.

Descriptors: *Soil water movement, *Unsaturated flow, *Hydraulic conductivity, *Pressure head, Darcys law, Hydraulic models, Percolation, Mathematical studies.

A systematic development of the consequences of an exponential dependence of the hydraulic conductivity upon the pressure head is presented. Alternative expressions for the flux are discussed in detail. For steady flows, partial differential equations in terms of the matric flux potential, the pressure head, and the total head are derived. For steady, plane and axially symmetric flows, partial differential equations for the stream function are given. A theoretical basis for the construction of viscous flow analogs for steady, plane and axially symmetric flows is also presented. (Knapp-USGS)
W72-03866

A FUNDAMENTAL MATHEMATICAL SIMULATION OF WATERSHEDS,
Ohio State Univ., Columbus. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02A.
W72-03911

RESEARCH, DEVELOPMENT, AND PROTOTYPE PRODUCTION OF AN ULTRAVIOLET SENSING SOIL MOISTURE METER,
Geotech, Garland, Tex.
J. B. Cohen.
Available from NTIS, Springfield, Va 22151 AD-837 529, $3.00 in paper copy; $0.95 in microfiche. Army Engineer Waterways Experiment Station Technical Report No 67-52 (Geotech, A Teledyne Company Contract Report No 3-176), August 1967. 29 p, 20 fig. DACA 39-67-C-0028.

Descriptors: *Soil moisture, *Moisture content, *Ultraviolet radiation, *Soil moisture meters, Analytical techniques, Research and development, Laboratory tests, Instrumentation.

The feasibility of measuring moisture content of soils was studied by measuring the amount of ultraviolet light transmission through moisture contained in a soil analog encased in a quartz-granule wafer emplaced in the soil. Results obtained from many combinations of soil analogs and system geometry indicate that the concept is operationally impractical. Selected instrumentation developed for the program was reapplied to investigations of promising variations of the initial concept. One variation involved critical angle refractometry. Under laboratory conditions, refractometer-type systems repeatedly yielded signal outputs directly correlative with the percent (moisture) saturation of all soil samples provided. This performance was achieved independent of soil temperature and variations in index of refraction of the soil moisture. Field testing of critical angle refractometers is necessary for establishing the performance of, and specifications for, any operational units. A promising configuration for field test units was prepared. (Woodard-USGS)
W72-04048

2H. Lakes

LITTORAL TRANSPORT AND ENERGY RELATIONSHIPS,
National Oceanic and Atmospheric Administration, Detroit, Mich.
For primary bibliographic entry see Field 02J.
W72-03581

PROPERTIES OF LONGSHORE BARS IN THE GREAT LAKES,
National Oceanic and Atmospheric Administration, Detroit, Mich.
For primary bibliographic entry see Field 02J.
W72-03586

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 3. OHIO RIVER BASIN-VOLUME 1, OHIO RIVER ABOVE KANAWHA RIVER.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-03609

PLANT-AVAILABLE PHOSPHORUS STATUS OF LAKES,
Wisconsin Univ., Madison. Dept. of Water Chemistry; and Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 05C.
W72-03742

BIOLOGY OF THE NORTHERN PIKE IN OAHE RESERVOIR, 1959 THROUGH 1965,
Bureau of Sport Fisheries and Wildlife, Pierre, S.D. North Central Reservoir Investigation.
Thomas J. Hassler.
US Bur Sport Fish Wildl Tech Pap. 29/30. 3-13. Illus. Maps. 1969.
Identifiers: Biology, North Dakota, Northern, Oahe, Pike, Reservoir, South Dakota.

Variations in length, weight, and maturity of northern pike in Oahe Reservoir were associated with sex and year class. Females were larger and more numerous than males. Catches were dominated by the 1959 and 1962 year classes; the 1964 year class was missing. Annulus formation began in April and was completed by July. Some males formed an annulus before spawning; females formed one after spawning. Males generally matured at age I and females at age II. Since impoundment, large ear classes have been associated with a rise in water level above previous high levels in spring and continuation of the higher level through early summer.--Copyright 1971, Biological Abstracts, Inc.
W72-03787

THE EFFECT OF FISH PREDATION ON THE ZOOPLANKTON OF TEN ADIRONDACK LAKES, WITH PARTICULAR REFERENCE TO THE ALEWIFE, ALOSA PSEUDOHARENGUS,
New York State Coll. of Agriculture, Ithaca.
Brendan P. Hutchinson.
Trans Amer Fish Soc. 100 (2): 325-335. Illus. 1971.
Identifiers: Adirondack, Alewife, Alosa-Pseudoharengus, Bosmina, Chironomids, Cyclops, Daphnia, Diaptomus, Epischura, Fish, Holopedium, Lakes, Macrocyclops, Mesocyclops, Plankton, Predation, Tropocyclops.

Stomach contents of alewives collected in Black Pond in 1958 consisted primarily of Diaptomus, Epischura, Mesocyclops, and Daphnia. Food of Black Pond alewives in 1966 consisted mainly of Bosmina, Holopedium, cyclopoid copepods (Cyclops, Macrocyclops, Tropocyclops), and chironomid pupae. Alewife stomach contents were compared with limnetic plankton samples to determine whether the aliwives were selective in their choice of food organisms. Both species and size selectivity were observed. The evidence collected suggests that alewife predation was responsible for a change in the zooplankton community of Black Pond. The zooplankton communities of 10 Adirondack lakes wereared. The species and size composition of these communities appeared to be influenced by the presence of planktovorous fish.--Copyright 1971, Biological Abstracts, Inc.
W72-03788

GROWTH AND CONDITION OF THE CARP AND THE RIVER CARPSUCKER IN AN ALTERED ENVIRONMENT IN WESTERN KANSAS,
Nebraska Forestry and Park Commission, Lincoln.
Norman P. Stucky, and Harold E. Klaassen.
Trans Amer Fish Soc. 100 (2): 276-282. 1971.
Identifiers: Carp, Carpiodes-Carpio, Carpsucker, Condition, Cyprinus-Carpio, Environment, Growth, Kansas, River, Western.

This study was designed to assess the populations of the carp, Cyprinus carpio Linnaeus, and the river carpsucker, Carpiodes carpio (Rafinesque), in Cedar Bluff Reservoir, and the Smoky Hill River, west-central Kansas. Three variables growth rate, condition factor, and percentage fat content--were used to evaluate the 2 populations. Data were collected from the spring 1967 to the fall of 1968. Mean calculated lengths of carp at different ages in the reservoir were comparable to lengths of fish in the river. The growth of the carpsucker was slightly greater in the reservoir than in the river. The condition coefficients of carp in the river were significantly higher than those of carp in the reservoir, but no significant differences existed between carpsucker in the 2 environments. The percentage fat content of carp from the river was significantly greater than that in the carp from the reservoir, but the percentage fat content of the carpsucker from the 2 environments was not significantly different. The higher fat content and the more robust condition of the carp in the river indicated that this environment was more suitable than the reservoir for this species. The slightly increased growth rate of the carpsucker in the reservoir and the similarity of the other data imply that the reservoir may be a slightly more suitable habitat than the river for this species.--Copyright 1971, Biological Abstracts, Inc.
W72-03789

AGE, FOOD, AND MIGRATION OF SEA-RUN CUT-THROAT TROUT, SALMO CLARKI, AT EVA LAKE, SOUTHEASTERN ALASKA,
Alaska State Dept. of Fish and Game, Juneau. Sport Fish Div.
Robert H. Armstrong.
Trans Amer Fish Soc. 100 (2): 302-306. 1971.
Identifiers: Age, Alaska, Amphipods, Cutthroat, Eva, Food, Insects, Lake, Migration, Salmo-Clarki, Sea-Run, Stickleback, Trout.

Information was collected on sea-run S. clarki from the Eva Lake system on Baranof Island, Southeastern Alaska. Migrations of 1210 to 1594 out-migrants and 1203 to 1682 in-migrants were recorded at a weir across the outlet of Eva Lake. Migration peaks occurred in mid-May (out-migrants) and mid-Sept. to early Oct. (in-migrants). No movement of cutthroat was noted at the weir from Dec. through Feb. Ages of out-migrant cutthroat ranged from 3 to 10, with the majority showing 5, 6, and 7 annuli on their otoliths. The numbers of annuli considered to be formed prior to smolt migration were 2 (3%), 3 (80%) and 4 (17%). Stomach contents consisted primarily of salmon young and insects during the summer and stickleback and insects during the winter in Eva Lake. The fish fed mostly on insects during their out-migration and amphipods and salmon young in salt water. Results of the Eva Lake Study and other studies on sea-run cutthroat are compared.--Copyright 1971, Biological Abstracts, Inc.
W72-03792

FOOD HABITS AND FEEDING CHRONOLOGY OF YOUNG WHITE CRAPPIE, POMOXIS ANNULARIS RAFINESQUE, IN CONOWINGO RESERVOIR,
Alabama Cooperative Fishery Unit, Auburn, Ala.
Dilip Mathur, and Timothy W. Robbins.
Trans Amer Fish Soc. 100 (2): 307-311. 1971.
Identifiers: Alona, Bosmina, Chronology, Conowingo, Crappie, Cyclops-Spp, Daphnia-Spp, Diaptomus, Feeding, Food, Habits, Leptodora, Pomoxis-Annularis, Reservoir, River Susquehanna, White, Young.

In Conowingo Reservoir most of the food consumed by young white crappie over one 24-hour period was eaten during daylight hours, most of it during the morning and early afternoon. The maximum number of organisms was present during mid-afternoon. Daphnia spp. and Cyclops spp. were the most important food items. The consumption of these items changed significantly over the 24-hr period of study. It was estimated that the food items eaten by young white crappie passed through the stomach in 14 to 17 hr. Data on seasonal food studies of young white crappies indicated that they fed exclusively on zooplankton in most months. Daphnia spp. were important in the diet in June through Oct. Cyclops spp. were important in Sept. through April. Chironomid larvae and pupae were most eaten in April and May. Bosmina sp., Leptodora sp., Alona sp., Diaptomus sp., amphipods, mayfly nymphs, and algae were also eaten seasonally in small quantities. The diet was more varied in late fall, winter, and early spring months than in the summer. Feeding activity was highest in May through Oct.--Copyright 1971, Biological Abstracts, Inc.
W72-03793

ENVIRONMENTAL INFLUENCES ON EXTENDED SPAWNING OF RAINBOW TROUT (SALMO GAIRDNERI),
Department of Lands and Forests, Toronto (Ontario).
Douglas P. Dodge, and Hugh R. MacCrimmon.
Trans Amer Fish Soc. 100 (2): 312-318. Illus. Map. 1971.
Identifiers: Environmental , Extended, Rainbow, Salmo-Gairdneri, Season, Spawning, Temperature, Trout.

Variations in discharge and water temperature influenced movements of spawning rainbow trout between Lake Huron and Bothwell's Creek. Adults entered the stream between 29 Oct. and 15 May, with numerical peaks in late Dec., and between 16 Feb. and early April, following major freshets and associated rising water temperatures. Between 31 Jan. and 13 Feb., during a period of minimal stream discharge and low water temperatures to 0.3 C, no new fish entered the stream, but spent and spawning-scarred fish moved downstream, and disappeared after a mid-Feb. freshet. Spent trout of the later run moved downstream during late April and early May. Spawning occurred first on 27 Dec. in the upper reaches at 6 C, and by early Jan. elsewhere in the stream. Activity increased with rising water temperatures, peaking during late March and early April at water temperatures of 6 to 8 C. Aborted attempts at spawning occurred on 2 June. Viable eggs resulted from Dec. and Jan. spawning at water temperatures of 0.3 and 2.0 C.--Copyright 1971, Biological Abstracts, Inc.
W72-03794

SURVIVAL OF HAND-REARED MALLARDS (ANAS PLATYRHYNCHOS) ON ARTIFICIAL FARM PONDS,
Kennedy High School, Bloomington, Minn.
Lawrence L. Thomforde.
J Minn Acad Sci. 37 (1): 23-26. 1970/1971.
Identifiers: Anas-Platyrhynchos, Artificial, Band, Farm, Hand, Mallards, Ponds, Reared, Recoveries, Survival.

The survival of hand-reared, game-farm mallards released on artificial farm ponds was studied in Goodhue County, Minnesota. Of the 300 ducklings released each year from 1965 through 1967, an average of 45% survived until most were capable of flying. More ducklings survived when released on ponds fenced from livestock than on unfenced ponds. Grazing livestock severely reduce cover vegetation around unfenced ponds. A total of 3.7% of the bands were recovered. The 1st yr recoveries represent 64% of all the bands reported. Thirty-nine per cent of the band recoveries occurred within 15 mi. of the release site.--Copyright 1971, Biological Abstracts, Inc.
W72-03797

PHOSPHORUS-33 AUTORADIOGRAPHY USED TO MEASURE PHOSPHATE UPTAKE BY INDIVIDUAL ALGAE,
Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 05C.
W72-03810

A PRELIMINARY STUDY ON THE UTILIZATION OF LAMINAR JET FLOWS FOR REMOVAL OF BENTHIC DEPOSITS,
Massachusetts Univ., Amherst. Water Resources Research Center.
A. M. Shen, and J. M. Colonell.
Available from the National Technical Information Service as PB-206 195, as $3.00 in paper copy, $0.95 in microfiche. Massachusetts Water Resources Research Center Publication No 18, 1971. 31 p, 7 fig, 6 tab, 10 ref, append. OWRR B-005-Mass (3).

Descriptors: *Benthos, *Dispersion, *Lakes, *Laminar flow, *Jets, Methodology, Laboratory tests, Flumes, Sedimentation, Reynolds number, Reservoirs.
Identifiers: Benthic deposit removal.

One of the most significiant problems produced by bottom deposits is the gradual depletion in water storage capacity. A portion of bottom sediments, termed benthic deposits, with specific gravity only slightly greater than water will eventually settle down in a layer over the other bottom deposits or remain suspended in a thin layer just above the lake or reservoir bottom. The object of this study was to consider the removal of the benthic deposits with minimum disturbance to the surrounding water. A small flume was used in the laboratory to examine the possibility of employing a laminar jet for the removal of benthic deposits. The following conclusions were drawn from the experiments: (1) laminar jet flow could be developed in the flume when the Reynolds number in the inlet jets was between 300 and 500; (2) the length and velocity of laminar jet flow were apparently affected only by the Reynolds number in the inlet jets and, to some extent, by the flume width; and (3) the laminar jet flow has the capability to scour and transport sediments of specific gravity as high as 1.91. (Woodard-USGS)
W72-03860

THE LAKE ERIE CONGRESS - THE PROCEEDINGS OF THE FIRST SESSION.
Great Lakes Research Inst., Erie, Pa.
For primary bibliographic entry see Field 06B.
W72-03947

GEOCHEMICAL CYCLES INVOLVING FLORA, LAKE WATER, AND BOTTOM SEDIMENTS,
Maine Univ., Orono. Water Resources Research Center.
For primary bibliographic entry see Field 05C.
W72-03987

THE EFFECTS OF SELECTED FUNGICIDES AND SOIL FUMIGANTS UPON THE MICROFUNGI OF A CATTAIL MARSH,
Wisconsin State Univ., Oshkosh. Dept. of Biology.
For primary bibliographic entry see Field 05C.
W72-03992

THE LAKE NOQUEBAY PROJECT: AN EXPERIMENT IN PROBLEM-ORIENTED RESEARCH AND COMMUNITY SERVICE,
Wisconsin Univ., Green Bay.
For primary bibliographic entry see Field 06B.

W72-03993

GEOCHRONOLOGY OF LAKE SEDIMENTS,
Tata Inst. of Fundamental Research, Bombay (India).
For primary bibliographic entry see Field 02J.
W72-04028

FINGER-RAFTING IN FRESH-WATER ICE: OBSERVATIONS IN LAKE SUPERIOR,
Minnesota Univ., Duluth. Dept. of Geology.
For primary bibliographic entry see Field 02C.
W72-04044

INSECTICIDE ADSORPTION BY LAKE SEDIMENTS AS A FACTOR CONTROLLING INSECTICIDE ACCUMULATION IN LAKES,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 05C.
W72-04081

NUMERICAL STUDIES OF UNSTEADY FLOW IN THE JAMES RIVER,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W72-04084

2I. Water in Plants

THE PROTOPLASMIC BASIS FOR DROUGHT RESISTANCE: A QUANTITATIVE APPROACH FOR MEASURING PROTOPLASMIC PROPERTIES,
Minnesota Univ., St. Paul. Dept. of Horticultural Science.
For primary bibliographic entry see Field 03F.
W72-03670

EFFECT OF CCC ON SOME MORPHOLOGICAL AND PHYSIOLOGICAL TRAITS AND YIELD OF WHEAT UNDER A SEMIARID CLIMATE,
Novi Sad Univ. (Yugoslavia). Agricultural Research Inst.
For primary bibliographic entry see Field 03F.
W72-03694

HYDRAULIC CONDUCTIVITY IN TREES,
Canterbury Univ., Christchurch (New Zealand); and Lincoln Coll., Canterbury (New Zealand).
R. W. Heine.
Journal of Experimental Botany, Vol 22, No 72, p 503-511, August 1971. 4 tab, 25 ref.

Descriptors: *Hydraulic conductivity, *Trees, *Xylem, *Flow measurements, Conifers, Deciduous trees, Flow rates, Flow resistance, Estimating equations.
Identifiers: *Angiosperms, *Relative conductivity.

Specific conductivity is no longer considered an acceptable parameter in measuring tree stem water flow. Relative conductivity has restricted usefulness. Relative conductivity has the dimensions length squared, and is inversely proportional to xylem cross-sectional area. Analysis of relative conductivity data from various studies allows the following generalizations: (1) members of the same genus may show widely different values; (2) higher values are found only in deciduous trees; (3) conifers cannot be distinguished from the broad-leaved evergreens on the basis of this parameter; (4) the final height of a species cannot be correlated with its relative conductivity. Conductivity, which has the dimension (length cubed x time)/mass, is directly proportional to the total lumen area. In a stem containing vessels of varied diameter the mean vessel area is defined by an expression which takes account of Poiseuilles equation. A relationship between conductivity and relative conductivity is established. In comparing the results generated by the 2 parameters, systematic errors inherent in relative conductivity measurements are discussed. Angiosperm results from both types of data are in good agreement. (Casey-Arizona)
W72-03695

ROOT-SHOOT RATIOS OF NATIVE FOREST HERBS AND ZEA MAYS AT DIFFERENT SOIL--MOISTURE LEVELS,
For primary bibliographic entry see Field 03F.
W72-03701

ECOLOGICAL STUDIES IN THE VEGETATION OF THE SUDAN II. THE ECOLOGICAL RELATIONSHIPS OF THE VEGETATION OF KHARTOUM PROVINCE,
Khartoum Univ. (Sudan). Dept. of Botany.
M. Obeid, and A. Mahmoud.
Vegetation, Vol 23, No 3-4, p 177-198, 1971. 10 fig, 2 tab, 22 ref.

Descriptors: *Xerophytes, *Microenvironment, *Grazing, *Ecological distribution, *Biological communities, Soil moisture, Soil types, Topography, Runoff, Arid lands, Foreign countries, Vegetation, Limiting factors, Goats.
Identifiers: *Sudan, *Overgrazing.

In the floristically poor arid region around Khartoum, topography, soil type and water availability seem to be the major factors in the distribution of the 13 recognized plant communities. Small local differences in the topography control the direction of water, thus increasing the water of 1 area at the expense of another. This is confirmed by descriptions of plant distributions in each community relative to critical environmental factors. Besides physical conditions, grazing, and other forms of human interference operate on the vegetation of the area. Extensive grazing destroys the palatable species and provides a chance for non-palatable species to invade and to dominate. This was illustrated by maps of the distribution of both types of plants within 10 square mile quadrats in disturbed areas. In partially protected enclosures, the density and productivity of a palatable grass, Panicum turgidum, were far greater than in adjoining overgrazed areas. Goats are the most destructive grazers. Wood cutting for fuel is also an extremely destructive practice. (Casey-Arizona)
W72-03709

DEVELOPMENTAL MORPHOLOGY OF SWITCHGRASS AND SIDEOATS GRAMA,
Colorado State Univ., Fort Collins. Dept. of Range Science.
P. L. Sims, L. J. Ayuko, and D. N. Hyder.
Journal of Range Management, Vol 24, No 5, p 357-360, 1971. 4 fig, 6 ref.

Descriptors: *Plant growth, *Plant morphology, *Crop response, *Switchgrass, *Grama grasses, Grasses, Colorado, Measurement, Vegetation effects, Flowering, Rhizomes, Plant growth regulators, Crop production, Forages, Cultivation.
Identifiers: *Sideoats grama, *Growth rhythm, *Plant utilization, Vegetative expansion, Mowing, Proaxis buds, Herbage production, Plant reproduction, Plant shoots, Inflorescence, Internodes, Semiarid lands.

Two important grass plant characteristics are growth-rhythm and response to utilization. Developmental morphology of switchgrass and sideoats grama were investigated in a semiarid region of eastern Colorado. Morphological measurements were made from plant material collected randomly. Vegetative expansion, floral development, and responses to mowing were studied. Vegetative expansion in switchgrass was by rhizomes, proaxis buds, and continuation of arrested growth. Expansion in sideoats grama was by proaxis buds and continuation of arrested growth. Mowing at about 3cm aboveground decreased herbage production, stopped reproductive shoots after inflorescence elevation, started tillering from rhizomes and proaxis for both species, and decreased the length of the 3rd and 4th internodes of sideoats grama. Figures show lengths of morphological measurements. (Popkin-Arizona)
W72-03710

ENERGY LEVELS OF WATER IN A COMMUNITY OF PLANTS AS INFLUENCED BY SOIL MOISTURE,
Agricultural Research Service, Kimberly, Idaho.
J. W. Cary.
Ecology, Vol 52, No 4, p 710-715, Summer 1971. 1 fig, 14 ref.

Descriptors: *Soil moisture, *Xerophytes, *Plant root systems, *Soil-water-plant relationships, *Drought resistance, Leaves, Sugar beets, Metabolism, Drought tolerance, Plant physiology, Loams, Photosynthesis, Semiarid climates, Idaho, Germination, Irrigation practices.
Identifiers: *Plant water potential, *Soil water potential, *Seedlings.

There are two important plant drought resistance mechanisms: (1) vigorous and competitive root systems, (2) physiological adaptations permitting survival and growth at very low water potentials. Data is lacking on the relative importance of these mechanisms. Rows of sugar beet (Beta vulgaris) seedlings were established in south-central Idaho on Portneuf silt loam soil. All other plants that germinated from natural seed in the soil were allowed to grow, which included about 8 other wild and cultivated species. In late June the area was irrigated and divided in half, with 1 plot being irrigated throughout the summer. The other plot was not irrigated until the middle of August when it was subdivided and 1/2 was watered. Soil and leaf water potentials were continuously monitored. Throughout the study the most drought-tolerant plants were those with the largest, most fibrous and the most penetrating root systems. The water potentials of these plants decreased sharply during the middle of the day, suggesting that they continued to exchange water vapor, oxygen, and carbon dioxide with the surrounding air during most of the day. This indicated that they continued to grow during periods of low water potential. Apparently the drought tolerant plants utilized most drought resistance mechanisms. (Casey-Arizona)
W72-03711

PHENOLOGY AND CONTROL OF COMMON BROOMWEED ON TEXAS RANGELANDS,
Texas A and M Univ., College Station. Dept. of Range Science.
For primary bibliographic entry see Field 04A.
W72-03714

TECHNIQUES FOR MEASURING PLANT DROUGHT STRESS,
Nebraska Univ., Lincoln, Dept. of Horticulture and Forestry.
C. Y. Sullivan.
In: Drought Injury and Resistance in Crops, CSSA Special Publication No. 2, p. 1-18, 1971. 134 ref.

Descriptors: *Drought resistance, *Leaves, *Instrumentation, *Water balance, *Laboratory tests, Stomata, Turgidity, Moisture stress, Measurement, Plant physiology, Soil-water-plant relationships.
Identifiers: *Relative water content, *Water potential.

Measurements of drought resistance and drought stress have been bottlenecks in the problem of drought research. Drought research has lagged because much of the past research on plant responses to drought stress has been based on soil moisture rather than on plant water status. It is necessary that plant water stress be directly measured in all future research. Although several such measuring methods exist, all have advantages and

disadvantages and there is no single method or combination of methods which has gained universal acceptance. The various plant parameters which can be measured are described along with measurement techniques, their disadvantages, and interpretation of the results. These include: relative water content, water potential, leaf density, osmotic potential, stomatal closure and leaf diffusive resistance, and desiccation tolerance. (Casey-Arizona)
W72-03758

SUMMER FOODS OF THE CYPRINID FISH SEMOTILUS ATROMACULATUS,
Nevada Univ., Las Vegas. Dept. of Biology.
Willard E. Barber, and W. L. Minckley.
Trans Amer Fish Soc. 100 (2): 283-289. Illus. 1971.
Identifiers: Cyprinid, Dipterans, Ephemeropterans, Fish, Foods, Larvae, Mollusks, Semotilus-Atromaculatus, Summer.

Aquatic larvae and pupae, fishes, and molluscs together contributed 95% of the stomach contents of creek chubs from headwaters of the Mississippi River, Clearwater County, Minnesota, during the summer of 1965. As fish grew the changes in food items were from ephemeropteran nymphs and smaller dipterans to larger caddisfly and dipteran larvae, and then fishes. Chubs feed generally in proportion to availability of food organisms. Fishes fed most intensively during early evening and least in the morning. As summer progressed, a reduction in feeding intensity occurred.--Copyright 1971, Biological Abstracts, Inc.
W72-03790

PROPAGATION OF CHIRONOMID LARVA AS FOOD FOR FISH FRY,
Fish Culture Research Station, Dor (Israel).
A. Yashouv.
Bamidgeh. 22 (4): 101-105. Illus. 1970.
Identifiers: Asbestos, Chironomid, Fish, Food, Fry, Larva, Pans, Propagation.

Shallow asbestos pans (1 m in diameter and 6 cm deep) were lined with light soil, beach sand, etc. and used as culture vessels for growing large numbers of chironomid larvae. Water was passed slowly through the pans, and organic fertilizer, such as chicken manure, was used to enrich the culture water. Adult chironomids were attracted by the odor of the fertilizer and laid eggs in large numbers. Thinning of the larvae was accomplished weekly or more often. Yields were about 250-375 g/m sq/wk. Under plastic the cultures could be kept going all year.--Copyright 1971, Biological Abstracts, Inc.
W72-03796

THE THEORETICAL BASIS AND PRACTICAL APPLICATION OF A NEW METHOD OF SELECTION FOR DETERMINING WATER DEFICIENCY IN PLANTS,
Jozsef Attile Univ., Szeged (Hungary). Dept of Plant Physiology.
G. Palfi, and J. Juhasz.
Plant Soil. 34 (2): 503-507. Illus. 1971.
Identifiers: Amino-Acids, Chromatography, Deficiency, Determining, Isatine, Leaves, Method, New, Plants, Proline, Selection, Theoretical, Treatment.

On the basis of new theoretical considerations, a new and reliable method was elaborated for the rapid determination of water dificit in plant cultures. In paper-chromatograms of plants optimally supplied with water free proline is shown to be present in very small amounts, usually only as traces. Comparative experiments showed that in cases of water shortage the proline content of the leaves of the plant strikingly increases. This commonly occurs in every phase of development of mono- and dicotyledons. Drought-resistant plants synthetize more proline than varieties less resistant to water deficit when equally water deficient. By a method which does not require chromatography the procedure of tests has been accelerated so that leaf extract containing amino acid mixture was dropped onto a chromatogram paper and immediately treated with isatine. In this test the effect of slight, permanent or medium water deficit upon proline content is so great that extracts react with isatine to give an intense dark blue color which suppressed the reddish-brown color of other amino acids. To avoid the necessity of preparing isatine reagent frequently, because it loses its amino-acid sensitivity very rapidly, a new isatine solution was formulated. The isatine-paper indicator prepared with this solution keeps its reactivity with amino acids 5-6 mo. An unusually high proline concentration occurs also if the salt content of irrigation water or soil is high. The increase of the proline level indicates, therefore, physiological dryness.--Copyright 1971, Biological Abstracts, Inc.
W72-03809

REMOTE DETECTION OF MOISTURE STRESS: FIELD AND LABORATORY EXPERIMENTS,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 07B.
W72-04021

2J. Erosion and Sedimentation

PROCESSING AND ANALYSIS OF RADIOISOTOPIC SAND TRACER (RIST) STUDY DATA,
Oak Ridge National Lab., Tenn. Instrumentation and Controls Div.
H. R. Brashear, E. H. Acree, F. N. Case, P. A. Turner, and D. B. Duane.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D C, Volume 2; American Society of Civil Engineers, New York, N Y, p 821-830, 1970. 7 fig.

Descriptors: *Computer programs, *Data processing, *Tracers, *Sediment transport, Sedimentation, Tagging, Tracking techniques, Sands, Radioactivity techniques, Radioisotopes, Coastal engineering.
Identifiers: Sediment tracers.

Data collected during Radioisotopic Sand Tracer field tests are processed through digital computers. Data treatment requires computing and plotting the detector position and correcting the corresponding radiation count rates. The field data are recorded on punched paper tape and transferred to magnetic tape for input to data reduction programs. Navigation ranges are converted to rectangular geographical coordinates. Computer programs construct a count rate surface from data collected along track lines. This technique facilitates machine contouring and enables numerical integration of the count rate surface. The ultimate goal is to obtain an estimate of mean direction and volume of littoral transport. A radiation material balance is to be used to check the results. Several programs used to accomplish these tasks are operating at the Coastal Engineering Research Center and the Oak Ridge National Laboratory. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W2-03584

COASTAL PROCESSES FROM SPACE PHOTOGRAPHY,
Virginia Inst. of Marine Science, Gloucester Point.
M. M. Nichols.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D.C. Volume 2; American Society of Civil Engineers, New York, N.Y., p 641-649, 1970. 4 fig, 10 ref.

Descriptors: *Remote sensing, *Coasts, *Beaches, *Satellites (Artificial), Photography, Beach erosion, Sedimentation, Path of pollutants, Surveys, Data collection, Coastal engineering.
Identifiers: Coastal processes.

Photographs taken from space provide a new source of data concerning coastal processes. By utilizing high vantage points and broad views, orbiting space cameras can record large-scale processes at short time intervals. Major outflow plumes, fresh-salt water fronts, turbidity maxima and massive effluents are among the wide range of features observed. Coastal processes can be evaluated from space photography and the information may also be of use as a supplement to field and other remote sensing data. By 1972 satellite photography should be available on a routine basis for many coasts of the world. (See also W72-03078 thru W72-03114 and W72-03573 thru W72-03607) (Knapp-USGS)
W72-03572

REACH OF WAVES TO THE BED OF THE CONTINENTAL SHELF,
Western Australia Univ., Nedlands. Dept. of Civil Engineering.
R. Silvester, and G. R. Mogridge.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D.C. Volume 2; American Society of CIVIL Engineers, New York, N.Y., p 651-667, 1970. 6 fig, 1 tab, 28 ref.

Descriptors: *Waves (Water), *Sediment transport, *Continental shelf, *Erosion, Land forming, Surf, Geomorphology, Marine geology.

The physiography of Continental Shelves and their major composition of sediment indicate strongly their terrigeneous origin and their smoothing by wave action. This premise is supported by the geologic time over which waves have existed and the mass-transport velocity in these relatively shallow depths, particularly the net movement within the wave boundary layer at the bed. A wave train arriving obliquely to the shore can transport material along the coast, both beyond the breaker line and within the surf zone. For equal overall discharge in the two zones, the average sediment concentration offshore close to the bed must be reasonably small, indicating that transport near the beach could be a fraction of that from the breakers to the reach of the waves. This limit extends at least halfway across the Shelf. (See also W72-03078 thru W72-03114, and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03573

ISOPACHOUS MAPPING OF THE LOWER PATUXENT ESTUARY SEDIMENTS BY CONTINUOUS SEISMIC PROFILING TECHNIQUES,
Naval Oceanographic Office, Washington, D.C.
N. T. Stiles, and D. R. Wiesnet.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D.C., Volume 2; American Society of Civil Engineers, New York, NY, p 669-686, 1970. 10 fig, 1 tab, 10 ref.

Descriptors: *Sounding, *Estuaries, *Surveys, *Acoustics, *Silting, Channel morphology, Sedimentation, Stratigraphy.
Identifiers: Patuxent Estuary (Md).

The thickness and extent of the sediment cover in the Patuxent Estuary were determined using a continuous seismic profiling system. From these data, an isopachous map was prepared. The isopachous map provides the sub-bottom information required to determine optimum locations for placing test equipment on the river bottom. Mud-filled depressions are acoustically transparent to 12-kHz sound pulses. Based on the identification of first sub-bottom reflectors, these depressions are as much as 16 feet thick. The dominance of the thicker deposits east of the channel and evidence of a submerged terrace indicates that either the channel has migrated to the west, or that the channel of the Patuxent River at this location was larger in the past and has subsequently filled in much of the material in the eastern edge. (See also

W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03574

OBSERVATION OF SEDIMENT MOTION BY UNDERWATER-TELEVISION,
Research Station for Island and Coast Protection, Norderney (West Germany).
G. Luck.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D.C., Volume 2; American Society of Civil Engineers, New York, N.Y., p 687-708, 1970. 11 fig.

Descriptors: *Sediment transport, *Sedimentation, *Remote sensing, *Instrumentation, Surveys, Underwater, Photography.
Identifiers: Television (Underwater).

Sedimentological processes of motion were studied with underwater television. The processes of motion were visible and partly interpretable. It was not possible to correlate the local current velocity, load, or grain size distribution of the sediment. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03575

THE HISTORY OF THE DUTCH COAST IN THE LAST CENTURY,
Rijkswaterstaat-Deltadienst, The Hague (Netherlands). Coastal Research Dept.
W. T. Bakker, and D. Sj. Joustra.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D.C., Volume 2; American Society of Civil Engineers, New York, NY, p 709-728, 1970. 18 fig, 23 ref.

Descriptors: *Coasts, *Deltas, *Sedimentation, *Beach erosion, *Coastal engineering, Scour, Sediment transport, Littoral drift, Sands, Beaches, Shore protection, Shores, Tides.
Identifiers: Netherlands.

Conclusions of this paper are: The gross littoral drift along the dutch coast is in the order of 1.5 to 2 million cu m/year; the resulting net drift is mostly within the order of accuracy of the computation; The erosion of areas with groynes was much less than the erosion of adjacent areas, this effect is due partially to lee-side scour but mainly to decreased erosion in the protected area; The channels in the outer deltas of the Wadden mainly turn clockwise, which is probably the direction of the resultant transport there. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03576

STUDIES ON THE SHORE PROCESS AND WAVE FEATURES OF THE WESTERN COAST OF TAIWAN,
Taiwan Land Resources Development Commission, Taipei.
K. S. T. Chang, and F. L. W. Tang.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 2; American Society of Civil Engineers, New York, NY, p 729-737, 1970. 5 fig, 1 tab.

Descriptors: *Sedimentation, *Erosion, *Coasts, Coastal engineering, Paleohydrology, Coastal plains, Littoral drift.
Identifiers: *Taiwan.

The western coast of Taiwan has accumulated a vast area of tidal flats of sediment transported by numerous torential streams. Aerial photographs show 53,800 hectares of tidal land worth being reclaimed. This coast suffered from waves generated by winter monsoons as well as waves and swells caused by typhoons in the summer. In ancient times the sand supply exceeded that which was eroded. The rivers have been regulated since the beginning of this century and soil conservation works have been constructed. Thus the coast has begun to erode because of the sand supply which has been considerably decreased. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03577

STUDY OF MUDBANKS ALONG THE SOUTHWEST COAST OF INDIA,
Kerala Engineering Research Inst., Peechi (India). Coastal Engineering Div.
N. S. Moni.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D.C., Volume 2; American Society of Civil Engineers, New York, NY, p 739-750, 1970. 5 fig, 9 ref.

Descriptors: *Coasts, *Mud flats, *Waves (Water), *Surf, Ocean waves, Littoral drift, Sedimentation, Tides, Particle size.
Identifiers: *India, Mudbanks.

In the Southwest Coast of India, certain inshore areas have a special property of dampening wave action and producing regions of calm water even during the rough monsoon season, due to the dissipation of wave energy in the large quantity of colloidal suspension in the region. These regions are generally known as the 'Mud Banks'. They directly influence the equilibrium conditions of shore. The portion of the coast from Kozhokode to Trivandrum where the mudbanks are confined is coincident with an alluvial belt backed by laterite deposits. Mudbank deposits are greenish black, cohesive, and plastic. They consist predominantly of silt and clay fractions. The top layer of the bottom mud is in a state of liquidity. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03578

TURBULENCE AND SEDIMENT CONCENTRATION DUE TO WAVES,
Tokyo Univ. (Japan). Dept. of Civil Engineering.
K. Horikawa, and A. Watanabe.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 2; American Society of Civil Engineers, New York, NY, p 751-766, 1970. 12 fig, 1 tab, 11 ref.

Descriptors: *Current meters, *Sediment transport, *Surf, *Bed load, *Suspended load, Ripple marks, Instrumentation, Turbulence, Sediment load, Sedimentation, Beaches.
Identifiers: Turbulence meters.

A new electrolytic turbulence transducer was developed to measure the turbulent velocity fluctuation superposed on the oscillatory flow velocity in surf actions. The vertical distribution of turbulence intensity is described over one wave cycle, where the turbulence is induced by ripple marks on the movable bed of a wave flume. The correlation between the turbulence intensity and the characteristics of sediment particles is given and compared with data such as fall velocity and sediment concentration. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03579

EFFECTS OF NONUNIFORM WAVE ENERGY IN THE LITTORAL ZONE,
Massachusetts Univ., Amherst. Inst. of Coastal Research.
V. Goldsmith, and J. M. Colonell.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 2; American Society of Civil Engineers, New York, NY, p 767-785, 1970. 15 fig, 1 tab, 15 ref. Army Corps of Engineers Contract DACW 72-67-C-0004.

Descriptors: *Beach erosion, *Sedimentation, *Surf, *Ocean waves, Massachusetts, Beaches, Waves (Water), Sand bars, Tides.
Identifiers: Monomoy Island (Mass).

Monitoring of beach profile stations on the northeast end of Monomoy Island (Cape Cod) shows major variations in the amount of erosion and accretion. A close relationship was observed between changes in the beach and offshore portions of the profiles. Three distinct types of bars were noted: Subtidal bars parallel to the shoreline and located one to two thousand feet off those portions of the shoreline undergoing relatively small amounts of beach erosion; subtidal bars perpendicular to the shoreline and attached to areas of the shore undergoing large amounts of erosion; and large intertidal bars oblique to the shoreline and associated with the formation of the ebb-tidal delta and the resulting wave refraction patterns. The variations in erosion and accretion are related to the nonuniform distribution of energy within the waves. This nonuniformity of wave energy is attributed to refraction around the irregular bathmetry offshore, and it appears to produce shoreline protuberances of sand which are flanked updrift and downdrift by erosional zones. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03580

LITTORAL TRANSPORT AND ENERGY RELATIONSHIPS,
National Oceanic and Atmospheric Administration, Detroit, Mich.
L. Bajorunas.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 2; American Society of Civil Engineers, New York, NY, p 787-798, 1970. 4 fig, 2 tab, 10 ref.

Descriptors: *Sediment transport, *Great Lakes, *Littoral drift, Lake Huron, Beaches, Sands, Statistical models, Statistical methods, Waves (Water), Currents (Water), Sedimentation, Erosion, Beach erosion.
Identifiers: St. Clair River.

The littoral transport rates in the Great Lakes were obtained by using long-term averages from drift accumulations and by using hourly averages in the St. Clair River which receives sand from Lake Huron beaches. A combination of energy elements and environmental factors consisting of wave power and duration, current speed, and length of shoreline produces the best correlation with the transport rate. Dimensional analysis expands the process-response model by including sediment-size and specific-weight parameters. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03581

SYNOPTIC OBSERVATIONS OF SAND MOVEMENT,
Army Coastal Engineering Research Center, Washington, D.C.
D. B. Duane.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 2; American Society of Civil Engineers, New York, NY, p 799-813, 1970. 10 fig, 6 ref.

Descriptors: *Tracking techniques, *Sediment transport, *Littoral drift, *Surf, *Beaches, Sedimentation, Scour, Beach erosion, Coastal engineering, Bed load, Radioisotopes, Tracers, Surveys, Tagging.

Radioisotope tagging procedures, hardware development, field surveys, and data handling techniques permit collection and analysis of over 12,000 bits of sand transport information per hour over a survey track of approximately 18,000 feet. Data obtained with the system can be considered as nearby synoptic observations of sediment trans-

port in a single environmental zone or in adjacent beach, surf and offshore zones. Using sand tagged with isotopes of gold, experiments were carried out at several sites on the California coast. Transport seaward of peaking-breaking waves is less than transport on the beach face, which is less than transport in the plunge and surf zone. Because of these differences, tracing surveys confined to the foreshore or offshore zones produce data only partially indicative of transport in the zone of immediate concern to coastal engineers. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03582

AN UNDERWATER SURVEY SYSTEM FOR RADIONUCLIDE-TAGGED SEDIMENT TRACING,
Oak Ridge National Lab., Tenn.
E. H. Acree, H. R. Brashear, and F. N. Case.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D C, Volume 2; American Society of Civil Engineers, New York, N Y, p 815-820, 1970. 4 fig, 1 tab.

Descriptors: *Tracers, *Sedimentation, *Beaches, *Surf, *Tagging, Radioisotopes, Radioactivity techniques, Littoral drift, Surveys, Data collections, Sediment transport, Instrumentation, Coastal engineering.
Identifiers: Sediment tracers.

Survey equipment was designed for use in tracing sediment tagged with radionuclides. The system can operate on the dry beach, in the surf, and in deep water, making it possible to synoptically examine the beach face, surf zone, and off-shore marine environment. The ball-shaped radiation detector is towed behind an amphibious vessel. Data are collected on punched tape at a rate of one set of data (position, radiation counts, time) every two seconds. Gold-198 and xenon-133 are used for tagging sand. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03583

PROPERTIES OF LONGSHORE BARS IN THE GREAT LAKES,
National Oceanic and Atmospheric Administration, Detroit, Mich.
J. H. Saylor, and E. B. Hands.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D C, Volume 2; American Society of Civil Engineers, New York, N Y, p 839-853, 1970. 10 fig, 15 ref.

Descriptors: *Sand bars, *Great Lakes, *Lake Michigan, *Beaches, *Water level fluctuations, Coasts, Waves (Water), Sand spits, Sands, Lakes, Geomorphology, Topography.
Identifiers: *Longshore bars.

Longshore bars are permanent features along the windward coasts of the Great Lakes. Offshore bars migrate significantly due to changes in lake level; a rise of one-half meter in the surface of Lake Michigan between 1967 and 1969 was accompanied by a shoreward movement of bar crests and troughs over a distance averaging 30 meters. Elevations of the crests and troughs are also built upward toward new equiblibrium levels during rising water levels, but elevating of the crests lags the increase in stage. Extensive shore erosion occurs because of the reduced effectiveness of longshore bars in dissipating incident wave energy. The average crest depth increases linearly in the offshore direction. Average distances between crests increase exponentially. These relationships are preserved during the bar growth and shifting that accompanies long term changes in lake level. Bar troughs are characteristically crescent shaped, with no abrupt changes in slope. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03586

SOME SAND TRANSPORT PHENOMENA ON COASTS WITH BARS,
Danish Inst. of Applied Hydraulics, Copenhagen (Denmark).
M. Dyhr-Nielsen, and T. Sorensen.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D C, Volume 2; American Society of Civil Engineering, New York, N Y, p 855-865, 1970. 8 fig, 4 ref.

Descriptors: *Sand bars, *Sediment transport, *Littoral drift, *Surf, *Sedimentation, Erosion, Beach erosion, Model studies, Sands, Currents (Water), Meanders, Ocean waves, Coastal engineering.
Identifiers: Offshore bars.

Transverse, secondary currents are superposed on longshore currents. Some examples of the influence of these relatively weak transverse currents may have on the processes in the shore zone are discussed. Transverse currents have a parallel in the effect of secondary currents in alluvial streams, which although weak, give rise to such important phenomena as meandering. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03587

LABORATORY TESTS OF LONGSHORE TRANSPORT,
Army Coastal Engineering Research Center, Washington, D.C.
J. C. Fairchild.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D C, Volume 2; American Society of Civil Engineers, New York, N Y, p 867-889, 1970. 13 fig, 4 tab, 13 ref.

Descriptors: *Littoral drift, *Sediment transport, *Hydraulic models, Model studies, Surf, Waves (Water), Sedimentation, Currents (Water), Coastal engineering, Beaches, Coasts.

Tests were made in a shore process test basin with waves approaching the toe of a test beach at a 30-degree angle. Beach material was quartz sand with median diameter of 0.22 millimeter which was molded to a 1 on 10 slope before starting a test. Long crested waves generated in a constant depth of 2.33 feet traveled over the beach, shoaled and were refracted before breaking near the shoreline. The breaking action caused the sand to be transported along the shore in the direction of the longshore component of the wave energy flux. Transport rates of 2 to 170 cubic yards per day were measured. Analysis includes correlation of the measured rates to the longshore wave energy flux, and in some tests, to the longshore current. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03588

INFLUENCE OF GRAIN SIZE ON LITTORAL DRIFT,
Laboratorio Nacional de Engenharia Civil, Lisbon (Portugal).
J. Castanho.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D C, Volume 2; American Society of Civil Engineers, New York, N Y, p 891-898, 1970. 3 fig.

Descriptors: *Sediment transport, *Littoral drift, *Particle size, Bed load, Suspended load, Sedimentation, Currents (Water), Shear stress, Hydraulic models, Coastal engineering, Sediment discharge.

Influence of grain size in sediment transport depends on flow conditions. For bed load transport a maximum probably exists for load discharge as a function of grain size. The important parameter seems to be the ratio between the threshold shear stress and the flow shear stress. If the transport is mainly in suspension, then discharge should decrease when the diameter increases. When the transport is mainly through bed load discharge, then discharge will increase with increasing diameter, reaching a maximum and decreasing afterwards. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03589

COMPUTATION OF ALONGSHORE ENERGY AND LITTORAL TRANSPORT,
Stanford Univ., Calif. Dept. of Civil Engineering.
T. R. Mogel, R. L. Street, and B. Perry.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D C, Volume 2; American Society of Civil Engineers, New York, N Y, p 899-917, 1970. 2 fig, 4 tab, 16 ref.

Descriptors: *Waves (Water), *Surf, *Littoral drift, *Computer programs, Sediment transport, Coastal engineering, Beaches, Shoals, Refraction (Water waves), California.
Identifiers: San Francisco (Cal).

A study was made of the littoral regime of a section of the coastline of the city and county of San Francisco, California. The study included complete refraction analyses of all applicable deep water wave directions and periods, determination of breaker locations, and computation of alongshore energy and potential littoral transport for seven stations located just offshore along the thirty-foot depth contour. The waves are calculated from deep water locations to the shoreline using the Stanford Wave Refraction computer program. Wave breaking is assumed to take place whenever the computed wave height exceeds 0.78 times the local water depth. The combination of deep-water hindcast wave statistics, linear refraction of wave components and an empirical relation between energy and transport produced energy and transport patterns which clearly show that the average annual transport and energy direction is north and that the Farallon Islands and their associated shoaling region both block wave energy from the shore and bend and focus wave rays to zones not otherwise reachable. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03590

USE OF VOLCANOES FOR DETERMINATION OF DIRECTION OF LITTORAL DRIFT,
Norges Tekniske Hoegskole, Trondheim.
P. Bruun, and G. Viggosson.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D C, Volume 2; American Society of Civil Engineers, New York, N Y, p 935-953, 1970. 13 fig. 5 tab.

Descriptors: *Littoral drift, *Sediment transport, *Provenance, *Volcanoes, Waves (Water), Currents (Water), Surf, Ocean waves, Sedimentation.
Identifiers: *Iceland, Surtsey Volcano.

The littoral drift on the Icelandic south coast was investigated by means of topographic surveys and aerial photos. The littoral drift at Holsa is eastward, the drift at the shore between Affall to the west of Holtsos is neutral, and the drift from west of Jokulsa and up to Dyrholaey probably is eastward. Surtsey is a submarine volcano, which erupted on Nov. 14th, 1963 at 100 meters depth. In 6 days an island 600 m long and almost as wide, with an elevation of 60 meters, came into existence. The general trend of shoreline development was towards a rectangular shape. The island has two almost parallel sides running SW-NE and an accumulation area on the NE side, typical for an 'angular foreland'. The average orientation of the two parallel sides in 1964 was 27 degrees E of N, which is identical with the orientation of the shoreline west of Dyrholaey. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03591

THE DYNAMICS OF A COAST WITH A GROYNE SYSTEM,
Rijkswaterstaat-Deltadienst, The Hague (Netherlands). Coastal Research Dept.
W. T. Bakker, E. H. J. Klein Breteler, and A. Roos.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D C, Volume 2; American Society of Civil Engineers, New York, N Y, p 1001-1020, 1970. 23 fig, 12 ref, append.

Descriptors: *Coastal engineering, *Erosion control, *Beach erosion, *Surf, *Mathematical models, Computer programs, Erosion, Scour, Sedimentation, Littoral drift, Waves (Water), Ocean waves.
Identifiers: Groins.

A mathematical theory is given for the behavior of a coast after the construction of a groyne system. A computer program was made in which the influence of diffraction behind the groyne is taken into account. The coastal constants used in the theoretical model are expressed in terms of wave height and wave direction. Results are given of computations with a coastal model in which the coast is schematized to one line of littoral drift and a model in which the coast is schematized to a beach line and an inshore line. The influence of changing wave conditions is included in the model. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03592

CHARACTERISTICS OF SHINGLE BEACHES: THE SOLUTION TO SOME PRACTICAL PROBLEMS,
A. M. M. Wood.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D C, Volume 2; American Society of Civil Engineers, New York, N Y, p 1059-1075, 1970. 6 fig, 2 tab, 11 ref.

Descriptors: *Littoral drift, *Beach erosion, *Sedimentation, *Gravels, Surf, Sediment transport, Erosion control, Particle size, Coastal engineering.
Identifiers: *Shingle beaches.

Shingle beaches differ from sand beaches mainly in the mode of transport of the material and in the permeability of the beach. The typical beach forms are in consequence different and the typical problems of beach stabilization require different types of solution. The mechanism of littoral drift of shingle is controlled predominantly by the action of breaking waves. Longitudinal and transverse sorting of shingle sizes is a characteristic of a stable beach. Examples of schemes of management are provided for a beach with high littoral drift and a beach which has to be controlled as artificial cells. The accreting shingle beach may develop a steep in-shore profile. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03593

A COMPARISON OF FLUVIAL AND COASTAL SIMILITUDE,
Tetra Tech, Inc., Pasadena, Calif.
B. Le Mehaute.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D C, Volume 2; American Society of Civil Engineers, New York, N Y, p 1077-1096, 1970. 26 ref. Coastal Eng Res Center Contract DAC W 72-68-C-0020.

Descriptors: *Hydraulic similitude, *Hydraulic models, *Beaches, *Alluvial channels, *Sediment transport, Sedimentation, Erosion, Beach erosion, Topography, Roughness (Hydraulic), Sedimentary structures, Particle size, Dimensional analysis, Model studies, Coastal engineering.

The conditions of similitude for movable bed scale models of rivers and estuaries are compared with those of beaches and shorelines. Despite the fact that the knowledge in sediment transport by wave action is less advanced than in the case of steady current, the conditions of similitude for beaches are less stringent than for rivers. In particular, the effect of relative roughness is comparatively unimportant in the case of beaches, the necessity of similitude of head loss imposes an imperative condition in the case of scale models of rivers. An introduction to a natural law of distortion for beaches is presented as an analogy with the Lacey condition for rivers. (See also W <=):) * THRU W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03594

STUDY OF DURBAN HARBOR SILTING AND BEACH EROSION,
National Mechanical Engineering Research Inst., Durban (South Africa).
J. M. Jordaan, Jr.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D C, Volume 2; American Society of Civil Engineers, New York, N Y, p 1097-1116, 1970. 11 fig, 7 ref.

Descriptors: *Hydraulic models, *Beach erosion, *Harbors, *Dredging, *Sediment transport, Model studies, Beaches, Littoral drift, Currents (Water), Waves (Water), Ocean waves, Silting, Coastal engineering.
Identifiers: Durban (South Africa).

A scale model of seven miles of the coastline of Durban, South Africa, port limits and the inner harbor, was constructed to study combined wave, tide and wind action on transport of sand along the coast. The accumulation and dredging of sand near the harbor entrance was reproduced and various dredging and storage proposals were studied. The cause of beach erosion is attributed to the existence of an offshore shoal produced by the localized dumping of sand dredged from the harbor approaches. This shoal caused selective wave action along the coastline. Wind and tidal action had a major effect on the redistribution of sand on the beaches by a minor effect on the permanence of the harbor entrance channel. The northern beach, downdrift of the harbor entrance, was starved of littoral supply, due to maintenance of the harbor entrance by dredging and offshore dumping. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03595

OFFSET COASTAL INLETS,
Massachusetts Univ., Amherst. Inst. of Coastal Research.
M. O. Hayes, V. Goldsmith, and C. H. Hobbs, III.
In: Proceedings of the Tewlfth Coastal Engineering Conference, September 13-18, 1970, Washington, D C, Volume 2; American Society of Civil Engineers, New York, N Y, p 1187-1200, 1970. 9 fig.

Descriptors: *Inlets (Waterways), *Sedimentation, *Geomorphology, *Deltas, *Littoral drift, Channels, Sediment transport, Tides, Waves (Water), Beaches, Coasts.
Identifiers: Offset coastal inlets.

Offset coastal inlets are common on the coasts of New England and the northern Gulf of Alaska. In both areas, the dominant waves approach the shore at an oblique angle, resulting in a strong net littoral drift. The most common type of offset on these coasts is a downdrift offset. The downdrift side of the inlet protrudes further seaward than the updrift side. Wave refraction around the ebb-tidal deltas at the inlets is an important process in the formation of the downdrift offsets, as it creates a local reversal in drift direction just downdrift of the inlet, and allows sediment to accumulate there. Tidal current flow is segregated in the inlets, with the ebb flow more channelized than the flood. The type of inlet offset at any one location can vary through time. Studies of the changes at the Hampton Harbor, New Hampshire, inlet from 1776 to the present show two reversals from updrift to downdrift offsets during that interval. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03596

FIELD STUDY OF A TIDAL INLET, BIMINI, BAHAMAS,
Virginia Inst. of Marine Science, Gloucester Point. Div. of Physical, Chemical, and Geological Oceanography.
W. Harrison, R. J. Byrne, J. D. Boon, III, and R. W. Moncure.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D C, Volume 2; American Society of Civil Engineers, New York, N Y, p 1201-1222, 1970. 12 fig, 3 tab, 8 ref.

Descriptors: *Inlets (Waterways), *Currents (Water), *Sediment transport, *Tracers, Sedimentation, Sampling, Telemetry, Current meters, Sand waves, Ripple marks, Dunes, Channel morphology, Tides, Currents (Water), Photogrammetry, Mapping.
Identifiers: Bimini (Bahamas).

The bathymetry of an inlet in Bimini, Bahamas was mapped by standard photogrammetric techniques after photographing the bottom directly through the water column. The channel bottom is bare beachrock, bioclastic sands, and gravels. A nine-day time series of observations of current speed and direction, and water temperature and salinity was obtained at two depths at each of eight stations. Twelve-to-18-minute pulsations in the flow were often observed. Spectral analysis of near-surface current speeds shows significant peaks at 2.4, 3.2, 4.3, 6.7, and 12.3 hrs. Evolution of sand ripples and dunes was monitored over a 200-ft distance during one tidal cycle. The pattern of growth illustrates the differences in bedform geometry which may be expected to influence friction coefficients. Tracer sand was released on a flood current. Color-coded tracer sand was sampled by divers using strips of grease-coated plastic tape. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03597

RECENT HISTORY OF EROSION AT CAROLINA BEACH, N.C.,
Corps of Engineers, Wilmington, N.C. Coastal Engineering Studies Section.
L. Vallianos.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D C, Volume 2; American Society of Civil Engineers, New York, N Y, p 1223-1242, 1970. 9 fig, 2 photo.

Descriptors: *Beach erosion, *Littoral drift, *Inlets (Waterways), *Coastal engineering, *Tidal effects, Sediment transport, Erosion control, Waves (Water), Ocean waves, Currents (Water).
Identifiers: Carolina Beach (NC).

The reaction of shores adjacent to salient features which interrupt alongshore processes is an important consideration in engineering works on shores with littoral drift. The town of Carolina Beach, a seaside resort on the Atlantic Ocean in southeastern North Carolina, is a classic example of an area experiencing inordinate and costly erosion associated with an initially small manmade interruption on the updrift shore. In 1952, a channel was cut through the updrift barrier beach to connect the Atlantic Ocean and the Atlantic Intracoastal Waterway. The channel soon developed into a small, permanent coastal inlet having a width of approximately 550 feet and a depth of 15 feet. In the ensuing 17-year period, 1952-1969, this inlet entrapped over 4 million cubic yards of littoral

material, resulting in downdrift erosion which progressed southward to the town of Carolina Beach. A protective beach fill placed along the tow's ocean front in 1965 has suffered considerable erosion damage. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03598

RIO GRANDE BAR--THE CASE HISTORY OF A LAGOON OUTLET INTO A TIDELESS SEA,
Universidade Federal do Rio Grande do Sul, Porto Alegre (Brazil). Hydraulic Research Inst.
V. F. Motta.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D C, Volume 2; American Society of Civil Engineers, New York, N Y, p 1243-1261, 1970. 8 fig, 11 ref.

Descriptors: *Inlets (Waterways), *Sand bars, *Littoral drift, *Coastal engineering, Sedimentation, Beach erosion, Silting, Harbors.
Identifiers: Rio Grande Harbor (Brazil).

Rio Grande harbor, Brazil is near the outlet of Lagoa dos Patos and Lagoa Mirim. Several rivers in the State of Rio Grande do Sul flow into the two lagoons and discharge through Canal do Norte into a tideless sea. The outlet is on a sandy coast with littoral drift in both shoreline directions. Before breakwater construction, the bar was extremely unstable. From 1911 to 1916 two 4 km long rubble mound breakwaters were built. They deepened the entrance channel to 8 - 10 m but a new bar formed further offshore. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03599

SCOUR AROUND A CIRCULAR CYLINDER DUE TO WAVE MOTION,
Naval Civil Engineering Lab., Port Hueneme, Calif.
D. R. Wells, and R. M. Sorensen.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, D C, Volume 2; American Society of Civil Engineers, New York, N Y, p 1263-1280, 1970. 10 fig, 2 tab, 19 ref.

Descriptors: *Scour, *Waves (Water), *Piles (Foundations), *Coastal engineering, Erosion, Surf, Beach erosion, Model studies, Hydraulic models, Bed load, Flow around objects.
Identifiers: Scour around piles.

A vertical circular cylinder was used to simulate a pile in a two-dimensional wave tank, with a horizontal bed of fine sand. The magnitude and pattern of ultimate scour and the time interval required to reach this state were measured for six different conditions of wave steepness and relative depth. The critical velocity necessary to cause incipient motion in oscillatory flow is lower than that for steady state flow. A maximum of only 6000 waves are required to reach an ultimate scour depth and in most cases 3000 waves are sufficient. In all the scour experiments, the pile acted as a catalyst causing scour of the bed particles to be initiated whereas if the pile was not present little to no scour would have resulted. The maximum scour measured was approximately one pile diameter. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03600

COMPARISON OF MODEL AND BEACH SCOUR PATTERNS,
Texas A and M Univ., College Station. Coastal and Ocean Engineering Div.
J. B. Herbich.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Vol 2, American Society of Civil Engineers, New York, N Y, p 1281-1300, 1970. 9 fig, 5 tab, 9 ref.

Descriptors: *Scour, *Beach erosion, *Surf, Ocean waves, Waves (Water), Profiles, Sedimentation, Sand waves, Ripple marks, Hydraulic models, Model studies.
Identifiers: Galveston (Tex).

Artificial or natural barriers may be divided into two classes, those from which waves are reflected and those on which waves break. Any intermediate type that gives a combination of reflection and breaking may set up severe erosive action of the beach in front of barriers. When the reflected waves are superimposed on the incident waves a stationary spatial envelope of the combined incident and reflected waves is produced. The crests of the sand bed in a model study appeared fairly closely under the nodes of the envelope and troughs of the scoured sand bed appeared under the loops of the envelope. The predominant scouring pattern had a spacing between crests equal to one-half the wave length. Wave data taken during hurricane Beulah (October 1967) at Galveston were obtained from the Coastal Engineering Research Center. The wave data were analyzed, using spectral methods, and equivalent wave height and period at maximum spectral density were obtained. At Galveston the average spacing between sand wave crests was greater than the deep water wave length and about twice as long as the average wave length at 18 ft depth. The relationship between average scour depth and the average wave height is approximately equal to 0.160 for the East Beach area and equal to 0.142 for the Groin area. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03601

EQUILIBRIUM PROFILES OF MODEL BEACHES,
California Univ., Berkeley.
I. V. Nayak.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington D C, Volume 2; American Society of Civil Engineers, New York, N Y, p 1321-1340, 1970. 14 fig, 1 ref.

Descriptors: *Beaches, *Sediment transport, *Beach erosion, *Hydraulic models, Model studies, Dimensional analysis, Surf, Waves (Water), Particle size, Density, Geomorphology.
Identifiers: Beach morphology.

Two aspects of equilibrium beach profiles, (a) the criterion governing their type and (b) their reflection characteristics were studied using hydraulic models. Laboratory wave flumes used different sizes of quartz, ground walnut shell and ground plastic as movable bed material. The criterion for generation of a longshore bar can be described in terms of deep-water wave steepness and particle diameter. The slope is affected to a greater extent by specific gravity than grain size of sediment. It is also influenced by the incident wave steepness. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03602

STOCHASTIC ANALYSIS OF BEACH PROFILE DATA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
C. J. Sonu, and M. H. Young.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 2; American Society of Civil Engineers, New York, NY, p 1341-1363, 1970. 18 fig, 1 tab, 14 ref. ONR Contract N00014-69-A-0211-0003, NR 388 002.

Descriptors: *Beach erosion, *Sedimentation, *Geomorphology, *Stochastic processes, *Statistical models, Time series analysis, Mathematical models, Simulation analysis, Markov processes, Monto Carlo method.
Identifiers: Beach morphology.

Stochastic prediction of beach changes by means of a linear least-squares transfer function requires a knowledge of power spectra. Because most field data are too short to ensure stable analysis, an attempt was made to generate data artificially by a Monte Carlo simulation. The simulated data are amenable to standard stochastic analysis to yield power spectra, cross spectra, coherence functions, and phase lags. Comparison of the results with those derived from actual data shows reasonable agreement. The process of beach sediment storage involves a combination of classes of Markov Gaussian random processes, but the process of beach width change resembles a white noise. Coupling between these two parameters occurs in the lower frequency range with periodicities longer than about 8 days. Moreover, the beach width shows phase advance before sediment storage. The basic concept of the model will probably explain beach changes in various types of coasts. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03603

FIELD STUDY OF SURATHKAL BEACH,
Karnataka Regional Engineering Coll., Surathkal (India).
Rao P. Suryaprakasa, and P. Kassim.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 2; American Society of Civil Engineers, New York, NY, p 1365-1381, 1970. 7 fig, 6 ref.

Descriptors: *Beach erosion, *Sedimentation, *Geomorphology, Data collections, Sediment transport, Surf, Waves (Water), Beaches, Tides, Ocean waves.
Identifiers: *India.

Beach profile observations and sediment sampling were carried out for six months at frequent intervals to study the seasonal changes of Surathkal beach, India. The qualitative and quantitative changes of the beach were determined under varying wave and tide conditions. The maximum rate of erosion, the total quantity of material eroded, the critical wave steepness values, and the sediment characteristics of the beach are shown graphically. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03604

SEASONAL BOTTOM CHANGES, BOLINAS BAY, CALIFORNIA,
California Univ., Berkeley.
J. W. Johnson.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 2; American Society of Civil Engineers, New York, NY, p 1383-1396, 1970. 10 fig, 8 ref.

Descriptors: *Sedimentation, *Erosion, *Bays, *Currents (Water), *Seasonal, Tides, Surveys, Beaches, Beach erosion, Variability, Bottom sediments, Scour, Waves (Water).
Identifiers: Bolinas Bay (Calif).

Five bottom surveys over a period of a year were made in the north portion of Bolinas Bay, California. Comparisons between successive surveys permitted an evaluation of the areas and depths of scour and fill with the seasons and were correlated with littoral current measurements. Data for a 22-year period also were available on the position of the mean high-tide line over a limited length of beach. These data showed a cyclic variation of the position of the high-tide line with the season with the most variation from year to year occurring during the spring months. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03605

SEDIMENT DISTRIBUTION AND ITS RELATIONS TO CIRCULATION PATTERNS IN BOLINAS BAY, CALIFORNIA,
California Univ., Berkeley. Dept. of Civil Engineering.
P. Wilde, and T. Yancey.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 2; American Society of Civil Engineers, New York, NY, p 1397-1415, 1970. 10 fig, 24 ref. Army Corps of Engrs. Contract 72-67-C-0015.

Descriptors: *Bottom sediments, *Bays, *California, *Water circulation, Particle size, Mineralogy, Distribution patterns, Statistics, Currents (Water), Sedimentation, Sediment transport, Variability, Provenance, Tides.
Identifiers: Bolinas Bay (California).

Grain size and heavy mineral analyses of 6 cliff, 12 beach, and 44 marine sediment and rock samples from Bolinas Bay and its surrounding drainage area were done as part of a long term study of sediment transport on the continental shelf off Central California. Sediments in the bay are predominately very fine sands. The primary mode of the marine samples is in the range .088 to .125 mm; whereas, the primary mode for beach material is from .175 to .25 mm. The range of median diameters of the marine samples is from .07 to .14 mm. The median diameters show a trend of decreasing grain size seaward parallel to the depth contours except opposite the entrance to Bolinas Lagoon where a tongue of relatively coarser material cuts across the depth contours. The heavy mineral assemblage is predominantly green hornblende with secondary amounts of hypersthene and augite. The major source of heavy minerals is the San Francisco Bar. Secondary contributions come from Bolinas Lagoon and the adjacent cliffs. The annual sediment flux in Bolinas Bay is about 300,000 cubic yards. The bottom sediments in the Bay are apparently in quasiequilibrium. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03607) (Knapp-USGS)
W72-03606

SUCCESSIVE SALTATION OF A SAND GRAIN BY WIND,
Kyoto Univ., (Japan). Disaster Prevention Research Inst.
Y. Tsuchiya.
In: Proceedings of the Twelfth Coastal Engineering Conference, September 13-18, 1970, Washington, DC, Volume 2; American Society of Civil Engineers, New York, NY, p 1417-1427, 1970. 8 fig, 1 tab, 11 ref.

Descriptors: *Sediment transport, *Sands, *Saltation, Bed load, Model studies, Winds, Sedimentation, Wind erosion.

In order to establish the mechanics of sand transport in an air or water stream, the mechanics of saltation of sand grains should first be considered. In sand storms, most of the saltating sand grains on a granular bed sucessively continue the saltation motion. A theoretical approach to the saltation of a single sand grain on a fixed granular bed is proposed on the basis of the equations of motion for saltation and the dynamic characteristics of collision between a saltating sand grain and bed sand grains. Some experiments of the successive saltation of a single sand grain on a fixed granular bed were carried out. The theoretical relationships of the height and distance of saltation of a sand grain are in fairly good agreement in substance with the results of experiment. (See also W72-03078 thru W72-03114 and W72-03572 thru W72-03606) (Knapp-USGS)
W72-03607

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1966: PARTS 5 AND 6. HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS, AND MISSOURI RIVER BASIN.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-03608

SUSPENDED LOAD IN BHAGIRATHI RIVER SYSTEM,
Calcutta Port Commissioners (India). Hydraulics Study Dept.
A. N. Biswas.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 98, No HY1, p 315-318, January 1972. 2 fig, 1 tab.

Descriptors: *Suspended load, *Sediment transport, *Alluvial channels, Sediment discharge, Provenance.
Identifiers: Ganges River (India).

The Bhagirathi is a spill channel of the Ganges. It is nontidal for a length of about 150 miles. The Bhagirathi and its tributaries flow for only about 3 months in the freshets. For the rest of the year there is no discharge. The relationships of measured suspended load and discharge for the Bhagirathi River System are described. Sediment samples were taken at 0.2 depth and 0.8 depth by vertical type samplers. An analysis was made of the combined sample. Samples were collected from 5 to 7 verticals depending on the width of the channel at water level. Generally, there are two separate relationships, one for the smaller discharge range and the other for the greater discharge range. The sediment discharge coefficient is greater in the greater discharge range. Generally, the amount of transportable material increases with discharge. The Bhagirathi at Jangipur is an exception; the reason is variable flow conditions at the offtake of the Bhagirathi from the Ganges. At lower flood stages in the Ganges, the main Ganges flow is nearer the offtake. With greater discharge in the Bhagirathi, the main flow in the Ganges shifts away from the offtake, yielding less sediment to the Bhagirathi. (Knapp-USGS)
W72-03844

EINSTEIN BED-LOAD FUNCTION AT HIGH SEDIMENT RATES,
California Univ., Berkeley. Dept. of Engineering.
H. A. Einstein, and F. M. Abdel-Aal.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 98, No HY1, Paper 8652, p 137-151, January 1972. 10 fig, 2 tab, 16 ref, append.

Descriptors: *Sediment transport, *Bed load, *Suspended load, Density, Viscosity, Roughness (Hydraulic), Sediment load, Sedimentation, Alluvial channels, Settling velocity.
Identifiers: Sediment transport rate.

In alluvial channels consisting of fine sand beds, almost all the sediment load moves in suspension with high concentrations near the bed. These high concentrations affect many of the flow characteristics: the roughness is changed, the velocity profiles are altered, the density and viscosity of the fluid are increased, and the particle fall velocity and the von Karman coefficient are reduced. The Einstein bed-load function can be modified to better describe flows with high sediment rates of fine grain. Instead of a constant value of von Karman's coefficient of 0.4, both the distributions of velocity and suspended sediment use a variable value of von Karman's coefficient which is a function of a dimensionless parameter. The von Karman coefficient becomes 0.4 when the parameter is larger than 1. (Knapp-USGS)
W72-03851

WATER-MASS STRATIFICATION AND BED FORM CHARACTERISTICS IN EAST PASS, DESTIN, FLORIDA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 02L.
W72-03854

ANATOMY OF A SHORE FACE RIDGE SYSTEM, FALSE CAPE, VIRGINIA,
Old Dominion Univ., Norfolk, Va. Inst. of Oceanography.
D. J. P. Swift, B. Holliday, N. Avignone, and G. Shideler.
Marine Geology, Vol 12, No 1, p 59-84, January 1972. 13 fig, 57 ref.

Descriptors: *Beach erosion, *Bottom sediments, *Stratigraphy, *Sedimentation, *Continental shelf, Sands, Virginia, Topography, Geomorphology, Particle size, Sediment transport, Littoral drift, Waves (Water), Currents (Water).
Identifiers: False Cape (Va.).

The Middle Atlantic Shelf of North America is a broad sand plain, characterized by a subdued ridge and swale topography. Some ridges extend into or merge with the shore face. Three such ridges at False Cape, Virginia have second order ridges on their flanks. Systematic asymmetry of secondary ridge crests away from major troughs, toward major ridges, indicates that the ridges are maintained by coast-parallel currents forming a pattern of helicoidal flow cells. Median diameters decrease to the southwest along the ridge system. Troughs tend to be floored with a primary lag deposit of coarse, pebbly sand. Wave-winnowed crests consist of a secondary lag deposit of well-sorted, medium to fine-grained sand. Flanks are fine- to very fine-grained sand winnowed out of the crests. A basal unit consists of clayey fine-grained sand of probable Late Sangamon-Early Wisconsin age. An intermediate unit of relatively watery mud has yielded a radiocarbon date of 25,700 plus or minus 800. The uppermost unit is the modern sand sheet into which the ridges are molded. The innermost ridge and trough appear to be actively forming in response to south-trending coastal currents and the shelf tide during tropical and extra-tropical storms. The ridges appear to be moving westward. Coastal retreat appears to be occurring, with sea floor aggradation at the expense of the adjacent shore face. In this manner the retreating coast is generating a shelf relict sand blanket. (Knapp-USGS)
W72-03855

SEDIMENTOLOGICAL AND GEOCHEMICAL ASPECTS OF SEDIMENT AND WATER FROM TEN ALASKAN VALLEY GLACIERS,
Alaska Univ., College.
For primary bibliographic entry see Field 02C.
W72-03859

A PRELIMINARY STUDY ON THE UTILIZATION OF LAMINAR JET FLOWS FOR REMOVAL OF BENTHIC DEPOSITS,
Massachusetts Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 02H.
W72-03860

ON THE DEPOSITION OF SUBGLACIAL AND MELT-OUT TILLS AT THE MARGINS OF CERTAIN SVALBARD GLACIERS,
University of East Englia, Norwich (England). School of Environmental Sciences.
For primary bibliographic entry see Field 02C.
W72-03887

ON THE ORIGIN AND TRANSPORT OF ENGLACIAL DEBRIS IN SVALBARD GLACIERS,
University of East Anglia, Norwich (England). School of Environmental Sciences.
For primary bibliographic entry see Field 02C.
W72-03888

HYDROLOGIC-MORPHOMETRIC RELATIONSHIPS FOR A SYSTEM OF DELTA ARMS (GIDROLOGO-MORFOMETRICHESKIYE

ZAVISIMOSTI DLYA SISTEMY DEL'TOVYKH RUKAVOV),
State Oceanographic Inst., Moscow (USSR).
V. N. Mikhaylov.
In: Gidrologiya i gidrokhimiya morey i ust'yev rek; Gosudarstvennyy Okeanograficheskiy Institut Trudy, No 98, p 29-40, 1970. 4 tab, 25 ref.

Descriptors: *Sedimentation, *Deltas, *Channel morphology, *Channel flow, *Flow characteristics, Hydraulics, Discharge (Water), Bottom sediments, Particle size, Width, Depth, Velocity, Hydraulic gradient, Roughness (Hydraulic), Equations, Chezy equation, Mannings equation.
Identifiers: *USSR, Volga River, Danube River, Sediment concentration, Competence, Conveyance.

Empirical formulas relating hydraulic flow characteristics to morphometric channel characteristics have long been used for various computations in river hydrology but have generally not been applied to the computation of delta-arm characteristics. All of the formulas, known as hydrologic-morphometric relationships, can be reduced to 4 groups: (1) relationships where water discharge Q, slope I, and diameter of bottom sediments D (or roughness n) are used as independent variables and all other channel characteristics (width B, depth h, and average velocity V) are expressed in terms of the independent variables; (2) relationships where only Q and occasionally D are independent variables, while B, h, V, and I are treated as dependent variables; (3) relationships where sediment concentration p is used as an independent variable in addition to Q and D; and (4) relationships where all flow characteristics, including p, D, and n, are determined only by Q. Based on a combined analysis of the Chezy equation, the equation of conveyance after A.N. Gostunskiy, and the equation of steady channel flow after M.A. Velikanov, hydrologic-morphometric relationships are derived for a system of deltaarm channels in the USSR, including the Volga and Danube deltas. B, h, V, and I were expressed by Q, p, and D. Providing D and p in delta arms are approximately the same, relationships may be reduced to a simplified form suitable for calculating delta-arm characteristics. These relationships can be used (1) to calculate approximately the morphometric and hydraulic characteristics of delta-arms for a known bankfull discharge; (2) to calculate approximately the distribution of water discharges from known morphometric characteristics for bankfull stages; and (3) to determine the degree of stability of any arm and the direction of its development. (Josefson-USGS)
W72-03891

BEDLOAD DISTRIBUTION ON THE ESTUARINE BEACH OF THE AMU-DAR'YA RIVER (RASPREDELENIYE DONNYKH OTLOZHENIY NA UST'YEVOM VZMOR'YE AMU-DAR'I),
State Oceanographic Inst., Moscow (USSR).
For primary bibliographic entry see Field 02L.
W72-03897

STUDIES IN DOUBLE ASYMPTOTICS AND STRATIFIED FLUID FLOW,
Wisconsin Univ., Madison. Dept. of Mathematics.
For primary bibliographic entry see Field 02E.
W72-03991

HYDROLOGY, GEOLOGY AND EROSION BY LEACHING IN SKILLMAN BASIN ON THE WESTERN HIGHLAND RIM, LAWRENCE COUNTY, TENNESSEE,
Vanderbilt Univ., Nashville, Tenn. Dept. of Geology.
R. G. Stearns, and J. M. Wilson.
Available from the National Technical Information Service as PB-206 302, $3.00 in paper copy, $0.95 in microfiche. Tennessee Division of Water Resources, Water Resources Research Series, No 3, 1971. 51 p, 17 fig, 5 tab, 20 ref, 3 append. OWRR A-011-Tenn (2) and A-019-Tenn (1).

Descriptors: *Erosion, *Leaching, *Hydrogeology, *Groundwater movement, *Tennessee, Silica, Limestones, Bedrock, Surface waters, Infiltration, Streams, Precipitation (Atmospheric), Geochemistry, Water chemistry, Hydrologic data, Percolating water, Sedimentation.
Identifiers: *Skillman basin (Tenn), *Western Highland Rim (Tenn).

The relationship between geohydrology and chemical weathering of Mississippian siliceous limestone on the Western Highland Rim of Tennessee is described. Skillman basin is a small (2.57 square mile) representative of myriads of tributary basins in the Western Highland Rim. Its 200 feet of relief spans the 200 foot thickness of the Fort Payne Formation. The basin is underlain by thin soil and colluvium beneath which is bedded and jointed chert saprolith which extends down as cutters into bedrock along joints. Precipitation has a pH of about 6 and a total dissolved solids content of about 15 ppm. When it percolates through soil it dissolves about 5 ppm SiO2 and decreases in pH to about 5. As water continues through saprolith it picks up more silica (to about 9 ppm), and upon coming in contact with bedrock it dissolves about 65 ppm hardness and deposits about 1 ppm silica on the top of bedrock. Surface water leaving the basin has about 75 ppm total dissolved solids, mainly in the form of calcium and magnesium hardness. During 1967 to 1970 erosion (approximately 200 tons of minerals per year was nearly all by chemical leaching. (Woodard-USGS)
W72-04020

RIVER BED TRANSPORT RELATED TO MEANDER MIGRATION RATES,
Research Council of Alberta, Edmonton.
C. R. Neill.
ASCE Proceedings, Journal of the Waterways, Harbors and Coastal Engineering Division, Vol 97, No WW 4, p 783-786, November 1971. 2 fig, 3 ref.

Descriptors: *Sediment transport, *Alluvium, *Alluvial channels, *Bed load, *Meanders, Erosion, Channel morphology, Sedimentation, Flood plains.

Many natural meandering rivers exhibit a systematic process of meander migration whereby the meander pattern sweeps downvalley. The sweep is accomplished by continual erosion on downvalley banks and deposition on upvalley banks. This process of channel shifting gives rise to a definite rate of transport of the eroded material. The key dimension in associating channel shift processes with sediment transport is the average length of travel of sediment particles between their erosion from a receding bank and their deposition on an accreting bank. Estimates of sediment transport by the morphologic method can be used to supplement estimates of bed load made by other methods. (Knapp-USGS)
W72-04025

OXIDATION-REDUCTION DETERMINATIONS AT THE MUD-WATER INTERFACE,
Georgia Univ., Athens. Dept. of Zoology.
For primary bibliographic entry see Field 02K.
W72-04027

GEOCHRONOLOGY OF LAKE SEDIMENTS,
Tata Inst. of Fundamental Research, Bombay (India).
S. Krishnaswamy, D. Lal, J. M. Martin, and M. Meybeck.
Earth and Planetary Science Letters, Vol 11, No 5, p 407-414, August 1971. 2 fig, 6 tab, 30 ref.

Descriptors: *Sedimentation, *Lakes, *Radioactive dating, *Lead radioisotopes, Cesium, Iron, Stratigraphy, Sedimentation rates, Radioactivity techniques, Bottom sediments.
Identifiers: Lake sediments.

Rates of sedimentation were measured in lakes using radiometric techniques. Pb-210 precipitated from the atmosphere is ideal for dating lake sediments of less than 100 yr age. In fresh waters, lead is quickly removed from solution to particulate matter so that unsupported Pb-210 activity in sediments is essentially due to overhead fallout from the atmosphere. In three lake sediments, the atmospheric Pb-210 activity lies between 5-50 dpm/g sediment dry weight, compared to the radium supported Pb-210 activity of about 2 dpm/g. Fe-55 activity was measured in the same cores dated by the Pb-210 method. Its activity is easily measurable in lakes and forms a method of pinpointing the sediment strata accumulated in 1963-64, the peak years of its fallout. The concentration of Cs-137 was also measured in a core which, however, was not dated by other methods. Analogous to Fe-55, Cs-137 activity is useful for identifying the sediment layer accumulated during 1963-64, although diffusion appreciably changes its depth distribution. Si-32 was measured in sediments from two lakes. Its activity is also measureable and promises to be useful as a dating method for sediments of less than 2000 yr age. (Knapp-USGS)
W72-04028

FRACTIONATION OF CALCIUM ISOTOPES IN CARBONATE PRECIPITATES,
Hahn-Meitner-Institut fuer Kernforschung Berlin (West Germany). nuclear Chemistry Div.
For primary bibliographic entry see Field 02K.
W72-04029

PALEOMAGNETIC DATING IN THE NORTH SEA BASIN,
Amsterdam Univ. (Netherlands). Geological Inst.
H. M. Van Montfrans.
Earth and Planetary Science Letters, Vol 11, No 3, p 226-235, June 1971. 8 fig, 2 tab, 25 ref.

Descriptors: *Paleoclimatology, *Bottom sediments, *Atlantic Ocean, *Magnetic studies, Stratigraphy, Sedimentation, Pleistocene epoch, Quaternary period.
Identifiers: *North Sea.

The Pleistocene sedimentary succession of the North Sea Basin was paleomagnetically correlated with the time-scale of geomagnetic reversals down to 1 million years. A detailed paleoclimatic curve, based on general changes in vegetation, is known for this region. The local Pliocene-Pleistocene boundary may be 2 million years or older. The four classical ice ages of the Alps probably took place in the last 0.7 million years. (Knapp-USGS)
W72-04030

GEOLOGY OF A NEWLY DISCOVERED SEAMOUNT IN THE NEW ENGLAND SEAMOUNT CHAIN,
Naval Oceanographic Office, Washington, D.C.
P. T. Taylor, and R. Hekinian.
Earth and Planetary Science Letters, Vol 11, No 2, p 73-82, May 1971. 6 fig, 3 tab, 17 ref.

Descriptors: *Bottom sediments, *Sedimentation, *Atlantic Ocean, *Stratigraphy, *Turbidity currents, Sampling, Surveys, Profiles, Sounding, Seismic studies.
Identifiers: Seamounts, Gilliss seamount.

A recently discovered seamount in the New England seamount chain, the Gilliss seamount, was selected for a detailed geological and geophysical study. From seismic profiler data it was noticed that two distinct acoustic patterns are present in the immediate vicinity of the seamount, one transparent, the other highly layered. Analysis of piston cores indicated the presence of foraminiferal ooze which could be related with the transparent acoustic pattern and turbidites representing the highly layered seismic pattern. Petrological and chemical studies of rock dredged from the seamount revealed the presence of extremely altered pillow lava fragments of basaltic composition. (Knapp-USGS)
W72-04031

GENESIS OF LONGITUDINAL AND OGHURD DUNES ELUCIDATED BY ROLLING UPON GREASE,
Texas Univ., Austin.
R. L. Folk.
Geological Society of America Bulletin, Vol 82, No 12, p 3461-3468, December 1971. 5 fig, 20 ref.

Descriptors: *Dunes, *Model studies, *Wind erosion, *Sedimentation, Sediment transport, Deserts, Sands, Turbulence, Vortices, Turbulent flow, Winds.
Identifiers: Langmuir circulation.

Longitudinal dune forms can be almost exactly simulated by running a roller across a layer of grease. This technique particularly duplicates the uniform spacing, the proper number and angle of dune junctures, and the fact that dune junctures always open upwind (or up-roller). Movement in the viscous grease layer accurately models helicoidal movement in the lower, boundary layer of the atmosphere. The longitudinal dune form is produced by alternately rotating pairs of horizontal roller vortices beneath the main movement of the geostrophic winds. Oghurd (star) dunes are simulated by lifting a sheet of cardboard vertically off a grease spot, thus indicating that convection cells developed by predominantly vertically moving air currents form the dunes. (Knapp-USGS)
W72-04033

TRANSVERSE BARS AND BRAIDING IN THE LOWER PLATTE RIVER, NEBRASKA,
Illinois Univ., Chicago.
N. D. Smith.
Geological Society of America Bulletin, Vol 82, No 12, p 3407-3419, December 1971. 9 fig, 2 tab, 26 ref.

Descriptors: *Sand bars, *Channel morphology, *Alluvial channels, *Braiding, *Scour, Channel erosion, Regime, Slopes, Stage-discharge relations, Rivers, Sediment transport, Nebraska.
Identifiers: Lower Platte River (Nebr).

The Platte is a wide, shallow river; its lower reaches carry a dominantly sandly load and during intermediate and low discharges display a pronounced braided character. Braiding is accomplished primarily through dissection of tabular, flat-topped transverse bars. Transverse bars form by sediment aggrading to a profile of equilibrium and grow by downcurrent extensions of avalanche faces. Depth, velocity, and grain size tend to decrease on active bar surfaces from their upstream mouths to the downstream and lateral margins. Braiding (bar dissection) begins during decreasing discharges when the flow passing through the bar mouth becomes unable to sustain active sediment transport over the entire bar surface. A single bar was examined closely over a five-day period of gradually decreasing discharge to document the evolution from wholly active to dissected states. (Knapp-USGS)
W72-04034

SUBMICROSCOPIC FROSTING ON EOLIAN AND SUBAQUEOUS QUARTZ SAND GRAINS,
Georgia Univ., Athens. Dept. of Geology.
S. V. Margolis, and D. H. Krinsley.
Geological Society of America Bulletin, Vol 82, No 12, p 3395-3406, December 1971. 5 fig, 1 tab, 19 ref.

Descriptors: *Sands, *Abrasion, *Electron microscopy, Dunes, Loess, Alluvium, Sediment transport, Quartz, Silica, Bed land, Suspended load.
Identifiers: *Sand grain textures.

On quartz sand grains of eolian origin from 20 desert and coastal dune environments, chemical solution and redeposition of silica by the action of desert dew and mechanical wind abrasion causes frosting and rounding. Wind-induced grain impacts create smallscale fractures that are related to wind velocity and moisture as well as to roundness, degree of polish, and size of the impacting grains. Examination with a scanning electron microscope shows that the fracture pattern consits of minute upturned plates of quartz that overlap each other and appear to be dipping in a direction possibly consistent with internal crystallographic planes. The close spacing of these fracture plates is responsible for the frosted appearance of many desert sands. These irregular fractured plates have a high chemical potential and will dissolve under favorable physico-chemical conditions. The occurrence, morphology, and distribution of diagnostic mechanical and chemical surface features allows differentiation between tropical desert sands, coastal dune sands, and periglacial sands. (Knapp-USGS)
W72-04035

PLEISTOCENE AND RECENT CHANNEL SEEPAGE FLATS IN NORTH-CENTRAL TEXAS,
Texas Tech Univ., Lubbock. Dept. of Geosciences.
For primary bibliographic entry see Field 02F.
W72-04050

2K. Chemical Processes

PHOTOGRAPHING MANGANESE NODULES ON THE OCEAN FLOOR,
Lamont Geological Observatory, Palisades, N.Y.
For primary bibliographic entry see Field 07B.
W72-03569

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1966: PARTS 5 AND 6. HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS, AND MISSOURI RIVER BASIN.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-03608

A SIMPLE, RAPID METHOD FOR DETERMINING TRACE MERCURY IN FISH VIA NEUTRON ACTIVATION ANALYSIS,
Basf-Wyandotte Chemical Corp., Wyandotte, Mich.
For primary bibliographic entry see Field 05A.
W72-03786

METAL IONS INTERACTION WITH SOILS OF DIFFERENT GENESIS AND PHYSICAL AND CHEMICAL PROPERTIES,
Tuskegee Inst., Alabama. Dept. of Agronomy.
For primary bibliographic entry see Field 02G.
W72-03840

THE CHEMISTRY OF THE BROADLANDS GEOTHERMAL AREA NEW ZEALAND,
Department of Scientific and Industrial Research, Wellington (New Zealand). Chemistry Div.
W. A. J. Mahon, and J. B. Finlayson.
American Journal of Science, Vol 272, No 1, p 48-68, January 1972. 4 fig, 8 tab, 25 ref.

Descriptors: *Geothermal studies, *Heat flow, *Water chemistry, *Water temperature, *Steam, Volcanoes, Hot springs, Thermal springs.
Identifiers: *Geothermal energy, *New Zealand.

Broadlands is a hydrothermal area in the Taupo Volcanic Zone of the North Island of New Zealand. The natural heat flow from the area is 17,500 kcals/sec. The area of the deep hot water system (9 sq km) is comparable to that at Wairakei. Hot water at temperatures up to about 300 deg C contains NaCl (1625 ppm), KCl (265 ppm), boron (32 ppm), and silica as major constituents and occurs at depths down to approximately 2,420 meters. Dissolved gas in the water is mainly carbon dioxide, at a concentration level near 0.14 molal. Concentrations of heavy metals in the water are low, but precipitates and sinters derived from the water contain high concentrations of arsenic, antimony, and heavy metals. D/H values in the water are similar to those present in local streams to the east, indicating that a high proportion of the hot water is derived from a meteoric source. (Knapp-USGS)
W72-03842

A NUMERICAL METHOD FOR COMPUTING EQUILIBRIA IN AQUEOUS CHEMICAL SYSTEMS,
California Inst. of Tech., Pasadena. W. M. Keck Labs.
F. Morel, and J. Morgan.
Environmental Science and Technology, Vol 6, No 1, p 58-67, January 1972. 12 fig, 4 tab, 12 ref.

Descriptors: *Numerical analysis, *Water chemistry, *Aqueous solutions, *Computer programs, Chemical precipitation, Chemical potential, Solutes, Equilibrium, Mathematical models.

A general purpose computer program was developed to study acid-base and coordinative interactions, dissolution, and precipitation in aqueous systems. The program uses the stability constant approach and the Newton-Raphson method for digital computation of equilibria. It is able to handle numerous species and to find the equilibrium set of solids. Gas phases are considered to be at constant partial pressures. The aqueous iron (III)-calcium-carbonate-phosphate system is calculated as an example. An application of the program to a system of 788 soluble species, 83 possible solids, and 1 gas-phase component is given as an illustration. (Knapp-USGS)
W72-03852

SEDIMENTOLOGICAL AND GEOCHEMICAL ASPECTS OF SEDIMENT AND WATER FROM TEN ALASKAN VALLEY GLACIERS,
Alaska Univ., College.
For primary bibliographic entry see Field 02C.
W72-03859

SEASONAL FLUCTUATIONS IN THE CHEMISTRY OF LIMESTONE SPRINGS: A POSSIBLE MEANS FOR CHARACTERIZING CARBONATE AQUIFERS,
Pennsylvania State Univ., University Park. Dept of Geochemistry and Mineralogy; and Pennsylvania State Univ., University Park. Materials Research Lab.
E. T. Shuster, and W. B. White.
Journal of Hydrology, Vol 14, No 2, p 93-128, November 1971. 34 fig, 2 tab, 23 ref.

Descriptors: *Water chemistry, *Hydrogeology, *Groundwater movement, *Carbonates, *Karst, Springs, Pennsylvania, Hardness (Water), Groundwater basins, Discharge (Water), Variability, Carbonate rocks, Limestones, Water circulation, Aquifer characteristics.
Identifiers: Carbonate aquifers.

The dissolved carbonate species were analyzed in the waters of 14 carbonate springs in the Central Appalachians at 2-week intervals during water year 1967-68. The springs were classified into diffuse-flow feeder-system types and conduit feeder-system types by hydrogeologic evidence. The conduit springs were very variable in hardness throughout the year (coefficient of variation 10-24%) whereas the diffuse-flow springs had a more constant hardness (coefficient of variation less than 5%). The variation in hardness is a better index of aquifer type than in hardness itself. Diffuse flow springs were, on the average, near saturation; the conduit springs were undersaturated by factors of 2 to 5. Ca/Mg ratios were near unity for springs fed by dolomites or dolomite-related rocks; Ca/Mg ratios for limestone springs were 3-8 times higher. Aquifer systems of quite different flow mechanics can exist in the same hydrogeologic environment and can be distinguished by their chemical behavior. (Knapp-USGS)

W72-03867

EFFECT OF PRESSURE ON SULFATE ION ASSOCIATION IN SEA WATER,
Rosenstiel School of Marine and Atmospheric Science, Miami, Fla.
F. J. Millero.
Geochimica et Cosmochimica Acta, Vol 35, No 11, p 1089-1098, November 1971. 3 tab, 20 ref. NSF Grant (GA 17386) ONR Grant (NONR 4008-02).

Descriptors: *Sulfates, *Sea water, *Water pressure, *Water chemistry, *Ionization, Solvation, Ions, Saline water systems, Chemical potential, Thermodynamics, Chemical reactions.
Identifiers: Ion association.

The effect of pressure on the association of Mg, Ca, and Na with the SO4 in seawater is estimated from partial molal volume data. The concentration of the ion-pair MgSO4 in seawater decreases with increasing pressure as expected. (Knapp-USGS)
W72-03868

OXYGEN ISOTOPE FRACTIONATION BETWEEN BIOGENIC SILICA AND OCEAN WATER,
Woods Hole Oceanographic Institution, Mass.
K. Mopper, and G. D. Garlick.
Geochimica et Cosochimica Acta, Vol 35, No 11, p 1185-1187, November 1971. 3 fig, 1 ref. NSF Grant GA-680.

Descriptors: *Oxygen, *Stable isotopes, *Bottom sediments, *Paleoclimatology, Silica, Sea water, Water chemistry, Water temperature, Stratigraphy.

Siliceous radiolaria skeletons in deep sea sediments may be used for oxygen isotope investigations. Radiolaria from the tops of all equatorial cores sampled are apparently 1.5 permil lighter than those sampled from lower portions of the same cores. Radiolaria probably equilibrate with cold bottom water within several thousand years. Therefore, O18 values of radiolaria may be employed as a tool for distinguishing recent sediments from Pleistocene sediments. However, it also seems possible that the trend is the result of early diagenetic mobilization and redistribution of silica in response to cold bottom water. (Knapp-USGS)
W72-03869

ELECTRICAL PHENOMENA ACCOMPANYING THE PHASE CHANGE OF DILUTE KCL SOLUTIONS INTO SINGLE CRYSTALS OF ICE,
Saint Louis Univ., Mo.
T. E. Osterkamp, and A. H. Weber.
Journal of Glaciology, Vol 9, No 56, p 269-277, June 1970. 5 fig, 2 tab, 15 ref.

Descriptors: *Crystallization, *Electrolytes, *Aqueous solutions, *Freezing, *Water chemistry, Electrochemistry, Chemical potential, Ionization.

The Workman-Reynolds effect was investigated during the phase change of dilute KCl solutions into single crystals of ice. The ice crystals were oriented with the c-axes either parallel or perpendicular to the growth direction. The solute distribution in the liquid phase, near the interface, was obtained with a wire-type conductivity cell. For a crystal growth rate of 8.8 microns/s the freezing potentials were +10.0 V and +6.0 V and the specific charge separations were 0.0000013 C/g of ice and 0.0000014 C/g of ice for growth parallel and perpendicular, respectively, to the c-axes of the ice crystals. The equilibrium solute distribution coefficient was found to be 0.004 for KCl solutions for both crystal orientations. An 'apparent' (because of convection in the liquid phase) distribution coefficient ranged from 0.031-0.074. The 'apparent' diffusion coefficients ranged from 0.0013 to 0.0049 sq mm/s and varied linearly with growth rate. (Knapp-USGS)
W72-03884

CHEMICAL INTERACTION OF DISSOLVED SILICA WITH IRON (II) AND (III),
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05F.
W72-04006

OXIDATION-REDUCTION DETERMINATIONS AT THE MUD-WATER INTERFACE,
Georgia Univ., Athens. Dept. of Zoology.
J. E. Schindler, and K. R. Honick.
Limnology and Oceanography, Vol 16, No 5, p 837-840, September 1971. 5 fig, 16 ref. OWRR A-029-GA (5).

Descriptors: *Mud-water interfaces, *Oxidation-reduction potential, *Bottom sediments, *Cores, *Instrumentation, Stratification, Organic matter, Sediment-water interfaces.

Oxidation-reduction (redox) potentials, while not amenable to strict thermodynamic interpretation, are valuable indicators of environmental boundary conditions. Intact samples of the mud-water interface and the overlying waters are obtained by means of a free-fall corer. Redox potentials (Eh) are determined with Ag/AgCl reference electrode and a bright platinum inert electrode in circuit with a potentiometric laboratory recorder. The rapid equilibration and high degree of reliability of the Pt-Ag/AgCl redox electrode couple and the essentially sealed experimental system described represent improvement over previous methods for the investigation of sediment-water interface phenomena. (Knapp-USGS)
W72-04027

FRACTIONATION OF CALCIUM ISOTOPES IN CARBONATE PRECIPITATES,
Hahn-Meitner-Institut fuer Kernforschung Berlin (West Germany). nuclear Chemistry Div.
P. Moller, and H. Papendorff.
Earth and Planetary Science Letters, Vol 11, No 3, p 192-194, June 1971. 1 tab, 8 ref.

Descriptors: *Chemical precipitation, *Calcite, *Radioisotopes, Calcium, Diagenesis, Chemical reactions, Sedimentation.
Identifiers: *Isotope fractionation.

CaCO3 was slowly precipitated from a bicarbonate solution containing Ca-45 in order to study the fractionation of Ca-isotopes. The ratio Ca-45 to total Ca was determined by radiochemical and chemical methods. The limit of error of the ratio is plus or minus 0.5% and the separation factor was 1.000 plus or minus 0.0015. Therefore the isotope shift in a CaCO3 precipitation must be less than 0.05% per mass unit. (Knapp-USGS)
W72-04029

ULTRAMICRO ANALYSIS OF EXPLOSIVES IN SEA WATER,
Naval Ordnance Lab., Silver Spring, Md.
For primary bibliographic entry see Field 05A.
W72-04037

2L. Estuaries

EXPERIMENTAL AND THEORETICAL STUDY OF THE HYDRODYNAMICS OF DISPERSION IN RIVERS AND ESTUARIES,
Hydronautics, Inc., Laurel, Md.
For primary bibliographic entry see Field 05B.
W72-03540

ISOPACHOUS MAPPING OF THE LOWER PATUXENT ESTUARY SEDIMENTS BY CONTINUOUS SEISMIC PROFILING TECHNIQUES,
Naval Oceanographic Office, Washington, D.C.
For primary bibliographic entry see Field 02J.
W72-03574

THE HISTORY OF THE DUTCH COAST IN THE LAST CENTURY,
Rijkswaterstaat-Deltadienst, The Hague (Netherlands). Coastal Research Dept.
For primary bibliographic entry see Field 02J.
W72-03576

OFFSET COASTAL INLETS,
Massachusetts Univ., Amherst. Inst. of Coastal Research.
For primary bibliographic entry see Field 02J.
W72-03596

FIELD STUDY OF A TIDAL INLET, BIMINI, BAHAMAS,
Virginia Inst. of Marine Science, Gloucester Point. Div. of Physical, Chemical, and Geological Oceanography.
For primary bibliographic entry see Field 02J.
W72-03597

SEASONAL BOTTOM CHANGES, BOLINAS BAY, CALIFORNIA,
California Univ., Berkeley.
For primary bibliographic entry see Field 02J.
W72-03605

SEDIMENT DISTRIBUTION AND ITS RELATIONS TO CIRCULATION PATTERNS IN BOLINAS BAY, CALIFORNIA,
California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02J.
W72-03606

FOOD HABITS, LENGTH-WEIGHT RELATIONSHIP, AND CONDITION FACTOR OF THE RED DRUM (SCIAENOPS OCELLATA) IN SOUTHEASTERN LOUISIANA,
Louisiana State Univ., Baton Rouge. School of Forestry and Wildlife Management.
Rea N. Boothby, and James W. Avault, Jr.
Trans Amer Fish Soc. 100 (2): 290-295. Illus. 1971.
Identifiers: Condition, Crabs, Drum, Factor, Food, Habits, Length, Louisiana, Red, Relationships, Sciaenops-Ocellata, Shrimp, Weight.

A total of 349 adult S. ocellata were collected from the coastal marsh below Hopedale in southeastern Louisiana, between Oct., 1967 and Oct. 1968. A total of 286 fish (82%) contained identifiable food items which were analyzed as to frequency of occurrence and percent of total volume. The main food items in order of occurrence were fish, shrimp, and crabs. Blue crabs, mud crabs, and penaeid shrimp were the crustaceans most frequently eaten, and at least 14 different species of fish were utilized to some degree. Food habits varied substantially from season to season. Fish was the main food item during winter and spring months. Crustaceans, crabs and shrimp combined comprised the bulk of the diet during the summer and fall months. Only slight differences in food habits were detected due to size or sex. Gonadal examination of 8 adults indicated that spawning took place between Sept. and Dec. The length-weight relationship and seasonal condition values were determined. Red drum of a given standard length were generally heavier than previously reported. Condition values from this study represented fish in overall good condition.--Copyright 1971, Biological Abstracts, Inc.
W72-03791

GRADUALLY VARYING TWO-LAYER STRATIFIED FLOW,
Technical Univ. of Denmark, Copenhagen. Inst. of Hydrodynamics and Hydraulic Engineering.
For primary bibliographic entry see Field 02E.
W72-03845

WATER-MASS STRATIFICATION AND BED FORM CHARACTERISTICS IN EAST PASS, DESTIN, FLORIDA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
L. D. Wright, C. J. Sonu, and W. V. Kielhorn.
Marine Geology, Vol 12, No 1, p 43-58, January 1972. 12 fig, 13 ref. ONR N00014-69-A-0211-0003, NR 388-002.

Descriptors: *Channel morphology, *Stratified flow, *Sediment transport, *Tides, *Currents (Water), Density stratification, Sedimentary structures, Bed load, Sands, Sedimentation, Tidal effects, Gulf of Mexico, Florida.
Identifiers: Destin (Fla.).

Density contrasts between the water of Choctawhatchee Bay and the Gulf of Mexico result in sharp vertical and horizontal stratification in the northern part of East Pass near Destin, Fla., during flood and a portion of the ebb tidal phases. As a consequence of this stratification, flood tide currents are swiftest and of longest duration in the deeper layers within dredged channels. Ebb currents attain their velocity and duration maxima in the upper layers of the water column. Accordingly, bed form asymmetries indicate that bedload transport is flood dominated in the channels and ebb dominated over shoals. Vertical density homogeneity resulting from greater mixing in the seaward reaches and at the mouth of the inlet channel is accompanied by bidirectional sand transport. (Knapp-USGS)
W72-03854

ANATOMY OF A SHORE FACE RIDGE SYSTEM, FALSE CAPE, VIRGINIA,
Old Dominion Univ., Norfolk, Va. Inst. of Oceanography.
For primary bibliographic entry see Field 02J.
W72-03855

EFFECTS OF KARST FEATURES ON CIRCULATION OF WATER IN CARBONATE ROCKS IN COASTAL AREAS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W72-03864

BEACHES AND GROUND WATER OF CAPE SABLE, FLORIDA, DURING EXTREME DROUGHT,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
R. J. Russell.
Available from NTIS, Springfield, Va. 22151 as AD 731 381 $3.00 Paper copy. Technical Report No 103, August 30, 1971. 18 p, 5 fig, 12 photo, 5 tab. N00014-69-A-0211-0003 (ONR).

Descriptors: *Beaches, *Groundwater, *Saline water intrusion, *Droughts, *Florida, Water table, Water levels, Geology, Groundwater movement, Groundwater recharge, Rainfall, Aquifers, Hydrogeology, Surveys, Hydrologic data.
Identifiers: *Cape Sable (Fla).

In October 1969 beaches and water tables were investigated after 5 months of adequate rainfall in the Cape Sable, Florida complex. In April 1971 a similar study was made after 5 months of extreme drought in the Florida Everglades when water tables were lowered enough to permit widespread saltwater intrusion. Much of the beach rock and cemented water-table rock under the beaches had been eroded by high-energy waves. Slabs of the eroded beach rock were tossed up on the beaches and became incorporated into the deposits. On East and Northwest Capes the groundwater had been replaced by seawater. On Middle Cape the water table was lowered, but a salinity gradient and some potable groundwater were present in 1971. The Cape Sable region is isolated from mainland surface runoff by extensive areas of lakes and saline waterways, and from subsurface flow of groundwater by a thick section of compact marl and compressed peat. Accumulation of groundwater depends on local rainfall. (Woodard-USGS)
W72-03872

KINEMATICS OF FLOW IN A RIVER MOUTH (O KINEMATIKE POTOKA V UST'YE REKI),
State Oceanographic Inst., Moscow (USSR).
V. N.Mikhaylov.
In: Gidrologiya i gidrokhimiya morey i ust'yev rek; Gosudarstvennyy Okeanograficheskiy Institut Trudy, No 98, p 5-22, 1970. 5 fig, 11 ref.

Descriptors: *Estuaries, *Sedimentation, *Hydraulics, *Flow characteristics, Waves (Water), Currents (Water), Tides, Surges, Floods, Water levels, Water level fluctuations, Depth, Discharge (Water), Sediment discharge, Velocity, Slopes, Cross-sections, Salinity, Energy, Equations.
Identifiers: *USSR, Flow kinematics, Flow dynamics, Flood tides, Ebb tides, Sediment concentration, Conveyance, Competence.

The sequence of extreme values of hydraulic elements for an unstable regime in the mouth of a river was examined to determine the difference between the kinematics of a flood wave and a flood tide (surge), and to establish kinematic patterns of the water-level regime, water and sediment discharges, flow velocity, slope, sediment concentration, and salinity during floods and incoming tides or surges. In positive and negative direct waves (floods), maxima in the positive wave or minima in the negative wave occur in the following sequence: slope, sediment concentration, velocity, water discharge, and water level (depth). In a negative return wave (backrush, ebb) water discharge, velocity, sediment concentration, and slope maxima occur first and are followed by the water-level minimum. In a positive return wave (surge, flood tide) without reversal of flow toward the river, the sequence of extreme values is as follows: water discharge, velocity, sediment concentration, and slope minima, followed by the water-level maximum. If a positive return wave is accompanied by reversing currents, the sequence of extreme values is the maximum of inverse slope, followed by the maxima of sediment concentration, return velocity, water discharge, and water level. In direct and return waves extreme sediment discharge values occur between the time of extreme water discharge and extreme sediment concentration. The sequence of extreme values of elements in a direct wave and positive return wave is similar when the current turns into a river. The kinematics of a negative return wave and of a positive return wave differ significantly from the kinematics of a flood wave when there is no reversal of flow. (Josefson-USGS)
W72-03893

BIOCHEMICAL OXYGEN DEMAND IN THE DNIEPER-BUG ESTUARINE AREA (BIOKHIMICHESKOYE POTREBLENIYE KISLORODA V DNEPRO-BUGSKOY UST-'YEVOY OBLASTI),
State Oceanographic Inst., Moscow (USSR).
For primary bibliographic entry see Field 05B.
W72-03895

BEDLOAD DISTRIBUTION ON THE ESTUARINE BEACH OF THE AMU-DAR'YA RIVER (RASPREDELENIYE DONNYKH OTLOZHENIY NA UST'YEVOM VZMOR'YE AMU-DAR'I),
State Oceanographic Inst., Moscow (USSR).
Yu. P. Sudakova.
In: Gidrologiya i gidrokhimiya morey i ust'yev rek; Gosudarstvennyy Okeanograficheskiy Institut Trudy, No 98, p 230-236, 1970. 2 fig, 8 ref.

Descriptors: *Sedimentation, *Bottom sediments, *Bed load, *Estuaries, *Beaches, Sands, Silts, Soil texture, Particle size, Grading, Detritus, Mollusks, Diatoms.
Identifiers: *USSR, Amu-Dar'ya River, Pelite, Ostracods, Foraminifera.

The estuarine beach of the Amu-Dar'ya River is divided into 7 soil zones on the basis of genetic characteristics: 3 sand zones (foredelta, western, and eastern), 3 silt zones (estuarine, central, and western), and a transitional zone of silty sand and sandy silt. All soils on the Amu-Dar'ya beach are strongly calcareous and effervesce from the action of hydrochloric acid. A pelitomorphic carbonate is predominant in the finer grained soils and a biogenous carbonate is predominant in the more coarse grained soils. Particle size of the soils of the various zones is examined in conjunction with the degree of their sorting, presence of shells, etc. The distribution of soils on the beach is asymmetric: sand zones in the east and silt zones in the west. The asymmetrical distribution of the zones is due mainly to the bottom relief, the general circulation of sea water, and the character of the underlying materials. (Josefson-USGS)
W72-03897

WIND TIDES IN THE ESTUARINE AREA OF THE PREGEL RIVER (SGONNO-NAGONNYYE KOLEBANIYA UROVNYA V UST'YEVOY OBLASTI R. PREGOLI),
State Oceanographic Inst., Moscow (USSR).
V. A. Zorina.
In: Gidrologiya i gidrokhimiya morey i ust'yev rek; Gosudarstvennyy Okeanograficheskiy Institut Trudy, No 98, p 67-75, 1970. 3 fig, 5 tab, 2 ref.

Descriptors: *Wind tides, *Winds, *Water level fluctuations, *Estuaries, *Estuarine environment, Lagoons, Floods, Surges, Anticyclones, Cyclones, Atmospheric pressure, Ice, Streamflow, Inflow, Sea water, Forecasting, Seasonal, Regression analysis.
Identifiers: *USSR, Kaliningrad Oblast, Pregel River, Vistula Lagoon, Water exchange, Correlation coefficient.

Statistical characteristics of wind tides which produce the greatest water-level fluctuations at the mouth of the Pregel River in the Vistula Lagoon, Kaliningrad Oblast, are examined. Water-level fluctuations in the lagoon are determined by the wind or pressure over the Baltic, local wind, and by streamflow. On the basis of these factors, the morphology of the lagoon, and the effect of ice phenomena, six types of wind tides are identified. Water exchange through the strait changes the average water level of the lagoon. Water levels are most affected by local wind and are only slightly influenced by streamflow. Methods are given for lengthening the period of seasonal water-level forecasts. Based on the relationships obtained, forecasts of water levels in winter and summer can be made 6-72 and 6-24 hours in advance, respectively. (Josefson-USGS)
W72-03899

POSSIBILITIES OF CALCULATING AVERAGE SALINITY DISTRIBUTION NEAR RIVER MOUTHS (VOZMOZHNOSTI RASCHETA SREDNEGO RASPREDELENIYA SOLENOSTI VBLIZI UST'YEV REK),
State Oceanographic Inst., Moscow (USSR).
Ye. B. Chernyavskiy.
In: Gidrologiya i gidrokhimiya morey i ust'yev rek; Gosudarstvennyy Okeanograficheskiy Institut Trudy, No 98, p 203-211, 1970. 2 fig, 1 tab, 13 ref.

Descriptors: *Estuaries, *Fresh water, *Sea water, *Salinity, Salt balance, Desalination,

Discharge (Water), Diffusion, Mixing, Turbulence, Turbulent flow, Statistical methods, Stochastic processes, Continuity equation.
Identifiers: *USSR, Amu-Dar'ya River, Isohalines.

Computation of salinity near river mouths can be of great importance for evaluating hydrologic conditions in an offshore zone between salinity surveys and for making hydrologic forecasts. With a reliable method it is possible to calculate the distribution of impurities discharged by rivers or pipes into the sea. A number of continuity equations of turbulent diffusion of an admixture entering the sea were examined from the standpoint of their applicability for calculating salinity distribution in an offshore zone. Formulas are given for computing the desalinization zone and average salinity of the basin, which is important for estimating future salt balances. Results of salinity calculations in the offshore zone of the Amu-Dar'ya River for July 1958 are summarized as a sample computation of salinity near a river mouth. (Josefson-USGS)
W72-03901

FLUORIDE CONCENTRATION IN COASTAL AND ESTUARINE WATERS OF GEORGIA,
Skidaway Inst. of Oceanography, Savannah, Ga.
For primary bibliographic entry see Field 05C.
W72-04026

COASTAL BATHYMETRIC PLOTTING FINAL REPORT,
North American Rockwell Corp., Downey, Calif.
For primary bibliographic entry see Field 07C.
W72-04045

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

INVESTIGATIONS ON THE SUBSURFACE DISPOSAL OF WASTE EFFLUENTS AT INLAND SITES,
Arizona Univ., Tucson.
L. G. Wilson.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Price $1.00. Office of Saline Water Research and Development Progress Report No. 650. 106 p, 22 fig, 10 tab, 65 ref. OSW Grant 14-01-0001-1805.

Descriptors: *Desalination, *Brine disposal, *Brackish waste disposal, *Recharge wells, Effluent discharge, Waste disposal, *Mixing, *Injection wells, Groundwater movement, Saline water, Surface-groundwater relationships, Dispersion, Pit recharge, Waste dilution.
Identifiers: *Inland desalting plants, *Evaporation ponds, Desalination waste, Waste disposal wells.

Two common techniques for brackish waste disposal at inland sites are evaporation ponds and deep-wells. A third possible technique, extensively employed in Israel, consists of in-situ mixing of waste water and indigenous ground water, using either single- and two-well recharge-discharge techniques or pit recharge. The objectives of a project undertaken by the Water Resources Research Center, The University of Arizona were (a) to obtain mixing data from single- and two-well studies and pit recharge experiments in inland alluvium for comparison with field and analytical studies reported in Israel and elsewhere and (b) to arrive at rational guidelines for the selection, design and management of mixing facilities at potential, inland desalting plants. In addition to waste-disposal potentialities, the techniques described in this report may have applicability during intrabasin transfers of ground water for quality control. (OSW Abstract)
W72-03512

COMPARISON STUDY OF A 2.5 MGD VTE UPFLOW VERSUS DOWNFLOW,
Fluor Corp. Ltd., Los Angeles, Calif.
M. Marwede, and P. J. Schroeder.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402 Price $3.75. Office of Saline Water Research and Development Progress Report No. 698, February 1971. 88 p, 7 fig, 4 tab, 30 draw, 2 ref. Contract No. 14-30-2703.

Descriptors: *Evaporation, *Water Costs, *Cost analysis, Films, Evaporators, Estimated costs, Design, Evaluation, Investment, Tubes, *Desalination, Distillation.
Identifiers: *Falling film evaporation, *Rising film evaporation.

The conceptual design and costs of a 2.5-Mgd vertical tube saltwater evaporator with upflow in the vertical tubes were determined and compared to a previous downflow plant. The upflow plant was made identical to the downflow plant except where differences were necessary to carryout the upflow scheme. The areas where the plants differ were studied in more detail. The principal difference between the plants is that the upflow plant does not require effect pumps but does require slightly more area. Capital cost for a 2.5-Mgd plant is about 6% lower for the upflow plant. A cost curve shows that this advantage improves as size increases to 10 Mgd. Water cost is lowered from $1.13 to $1.08 per 1,000 gal. because of lower capital charges and lower electrical costs. Potential improvements in the upflow process are recommended. (OSW Abstract)
W72-03514

FEASIBILITY OF TREATING WASTEWATER BY DISTILLATION.
Florida Univ., Gainesville.
For primary bibliographic entry see Field 05D.
W72-03610

NEW SYSTEM FOR DESALTING WATER.

Public Works, Vol 101, No 11, November 1970, p 78.

Descriptors: *Desalination, *Reverse osmosis, *Distillation, Capital costs, Cost comparisons, Economic efficiency, *Steam, Treatment facilities, Waste water treatment.

A method for desalting water combining the processes of distillation and reverse osmosis has been announced by Stone and Webster Engineering Corporation, of Boston Massachusetts. The firm claims the process, called Duo-Cycle, can be applied in large scale installations, 100 mgd, at costs significantly lower than heretofore claimed possible. The process uses high quality steam for the reverse osmosis cycle and the resulting low grade steam is then used in a heat exchanger to heat incoming brine for distillation. The streams of product water from each plant are combined in optimum economic proportions to form a potable water product. The facility described by the company would provide 130 mgd using the energy in 1,800,000 pounds of steam per hour at a pressure of 1450 psi gage at 950F. This was compared with a multi-stage flash distillation plant using comparable energy to produce 50 mgd. (Goessling-Texas)
W72-03626

THE CURRENT STATUS OF RESEARCH ON WATER AND SALT SOLUTIONS,
Carnegie-Mellon Univ., Pittsburgh, Pa.
For primary bibliographic entry see Field 01B.
W72-03773

SEA WATER CORROSION CONTROL BY ENVIRONMENT MODIFICATION; PART TWO,
Dow Chemical Co., Freeport, Tex.
B. D. Oakes, and J. S. Wilson.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Price $1.00. Office of Saline Water Research and Development Progress Report No. 649, May 1971. 91 p, 18 fig, 24 tab, 4 ref, 5 append. OSW Contract No. 14-01-0001-1482.

Descriptors: *Desalination, *Sea water, *Corrosion control, *Inhibitors, *Deaeration, Steel, Aluminum, *Heat exchanger, Chromium, Phosphates.

Environmental modifications were studied that will lower the cost of water obtained by distillation of seawater by allowing the use of mild steel surfaces. Laboratory testing indicates that chromate as sodium chromate plus phosphate as disodium hydrogen phosphate will effectively control corrosion in oxygen-saturated seawater at 250 deg F. Better control is obtained with this inhibitor if the seawater is also deaerated. Dynamic testing confirms that a low oxygen level plus a low level chromate-phosphate inhibitor concentration promises to control corrosion of mild steel in seawater at 250 deg F at costs that make the environmental modification well worth pursuing. Aluminum alloy corrosion rates can be lowered significantly below already low values and pitting suppressed by the addition of sodium chromate plus sodium bicarbonate. Dynamic testing of Aluminum 1100 gave surprisingly high rates -- >100 mpy -- but the inhibitor was able to lower them to <1 mpy. If it should prove to be possible to utilize the bicarbonate naturally present in seawater as the bicarbonate source, then the cost of the inhibitor would become that of the added chromate. Since 3 ppm chromate was effective in dynamic testing, the cost of added protection for aluminum would only be approximately 1 cent per thousand gallons of water produced, an attractive possibility. (OSW abstract)
W72-03774

SUMMARY OF ROSWELL TEST BED PLANT REPORTS (1963-1968).
Phillips Scientific Corp., Bartlesville, Okla.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402 - Price $0.75. Office of Saline Water Research and Development, Progress Report No. 717, September 1971. 56 p, 5 tab, 5 fig. OSW Contract No. 14-30-2596.

Descriptors: *Desalination, *Testing, Desalination plants, Distillation, Brackish water, *Vapor compression distillation, Corrosion, Pilot plants.
Identifiers: Roswell (NM).

This report summarizes the analyses of the operating data for the period 1963-1969 for the Test Bed Plant and the Auxiliary Test Unit (ATU) located at Roswell, New Mexico. The Roswell Test Bed plant uses a vapor compression distillation process with two effects. The feed water for the plant is produced from wells and contains about 1.5 percent total dissolved solids high in calcium sulfate. The plant was installed to operate with two different methods to prevent calcium sulfate scale deposits: ion exchange pretreatment and calcium sulfate slurry seed recirculation. Only the ion exchange method has been demonstrated in the Test Bed Facility. The Test Bed Facility demonstrated the design rate of one million gallons per day at a concentration factor of 3 but because of numerous equipment failures the plant never attained continuous operating times of greater than 28 days. Also based on past experience, it the plant is started up for a run, 64 percent of the time the test will be terminated in less than 10 days because of equipment failure. Scale deposits, corrosion and mechanical failures were responsible for most of the plant shutdowns. Operating data from the plant pretreating the water with ion exchange have defined conditions to avoid scale deposits except those scales containing silica. Mechanical problems involving the pumps and the axial compressor have not been completely solved.
W72-03775

IN-SITU DYNAMICALLY-FORMED REVERSE--OSMOSIS MEMBRANES,
Envirogenics Co., El Monte, Calif.
H. F. Shuey, and C. W. Saltonstall, Jr.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402 - Price $0.60. Office of Saline Water Research and Development Progress Report No. 730, December 1971. 57 p, 20 fig, 13 tab, 8 ref. Contract No. 14-30-2671.

Descriptors: *Reverse osmosis, *Semipermeable membranes, *Saline water, Desalination, Permselective membranes, Pressure, Cellulose, Membranes.
Identifiers: *Dynamic membranes, *Polysulfone supports, Cellulose acetate.

Membranes prepared by depositing ultrathin cellulose acetate disks in-situ upon a polysulfone substratum in tubes have exhibited rejections of 93 to 96% of sodium sulfate and 31.5 to 33.5% of sodium chloride at fluxes up to 17 gfd when evaluated on 3000 ppm test solutions at 800 psi and flow rates of 1 to 2 gal/min. Moreover, membranes with high sulfate rejections, such as these, did not pass dye when evaluated utilizing 100 ppm aqueous Trypan Blue dye at 800 psi. This indicates that the disks were uniformly distributed with sufficient overlap to prevent leakage. The low sodium chloride rejections are apparently a function of the intrinsic osmotic characteristics of the disks, rather than leakage due to improper deposition. Variations in the techniques of preparing the disks were found to influence the reverse-osmosis properties of the in-situ membranes. Thus, it should be possible to further improve the intrinsic osmotic characteristics of the disks. It was also demonstrated that a cellulose acetate disk membrane which had been formed in-situ did not show any decline in flux or rejection upon startup after an overnight shutdown and depressurization. This indicates that the membrane, once deposited, is stable to erosion or tearing under reverse-osmosis operating conditions. (OSW abstract)
W72-03776

RANKING RESEARCH PROBLEMS IN GEOTHERMAL DEVELOPMENT,
California Univ., Berkeley. Sea Water Conversion Lab.
Alan D. K. Laird.
Report available for sale by Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402 - Price $0.45. Office of Saline Water Research and Development Progress Report No. 711, August 1971. 33 p, 5 fig, 7 tab, 24 ref, 1 append. OSW Grant No. 14-30-2635.

Descriptors: *Desalination, *Distillation, *Geothermal studies, *Brine disposal, California, Water pollution source, Benefits, Electric power, Water supply.
Identifiers: Geothermal water-power, Geothermal feasibility studies, Geothermal economics, Imperial Valley (Calif).

Discusses research priorities for establishing feasibility of developing geothermal resources in the Imperial Valley. Priorities in order of decreasing importance are ranked (1) brine chemistry--first because, if some peculiarity of brines would require costly processing, the development may be precluded; (2) overall benefits--must be assured before development is undertaken; (3) choice of system; (4) markets; (5) reservoir management--needed for pilot plant planning; (7) demonstration-plant design; (8) technological improvements. Each of the above topics is discussed in detail together with the predicted interaction of the various parameters. The impact upon agricultural, industrial and social developments is discussed along with benefits to municipalities. The environmental aspect in terms of possible pollution, land misuse, geological damage, and the research necessary for their control is briefly evaluated. Two power-water schemes using flashed geothermal steam, and one in which boiling is suppressed are described and briefly illustrated. (OSW abstract)
W72-03777

MANUAL FOR DISSOLVED OXYGEN ANALYSIS,
Envirogenics Co., El Monte, Calif.
H. C. Edgington.
Report available for sale by Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 - Price $0.30. Office of Saline Water Research and Development Progress Report No. 712, August 1971. 19 p, 4 fig. OSW Contract No. 14-30-2586.

Descriptors: *Desalination, *Distillation, *Dissolved oxygen analyzers, *Volumetric analysis, *Analytical techniques.
Identifiers: *Winkler method, *End-point detection.

Three methods covering the determination of dissolved oxygen in seawater are given. Depending upon the method used, accuracies on the order of 0.5 ppb to 5 ppb are possible. Seawater samples are analyzed by an optimized Winkler procedure. Reagents used, together with directions for mixing and storing solutions are given. Apparatus used and procedures to be followed are explicit. (OSW abstract)
W72-03778

DEMINERALIZATION OF WASTEWATER BY THE TRANSPORT-DEPLETIC PROCESS,
Southern Research Inst., Birmingham, Ala.
For primary bibliographic entry see Field 05D.
W72-03782

CRITICAL POTENTIAL FOR GROWTH OF LOCALIZED CORROSION OF STAINLESS STEEL IN CHLORIDE MEDIA,
Akinomoto Co. Inc., Kawasaki (Japan). Central Research Labs.
For primary bibliographic entry see Field 08G.
W72-03853

3B. Water Yield Improvement

SHRUB PRODUCTIVITY: A REAPPRAISAL OF ARID LANDS,
Texas Tech Univ., Lubbock. Dept. of Biology; and Utah State Univ., Logan. Dept. of Range Service.
For primary bibliographic entry see Field 03F.
W72-03663

WATER CONSERVATION FOR FOOD AND FIBER PRODUCTION IN ARID LANDS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 03F.
W72-03667

ECOLOGICAL STUDIES IN THE VEGETATION OF THE SUDAN II. THE ECOLOGICAL RELATIONSHIPS OF THE VEGETATION OF KHARTOUM PROVINCE,
Khartoum Univ. (Sudan). Dept. of Botany.
For primary bibliographic entry see Field 02I.
W72-03709

ECONOMIC FEASIBILITY OF INCREASING PECOS BASIN WATER SUPPLIES THROUGH REDUCTION OF EVAPORATION AND EVAPOTRANSPIRATION,
New Mexico Univ., Albuquerque. Dept. of Economics.
W. C. Hughes.
Available from the National Technical Information Service as PB-206 139, $3.00 in paper copy, $0.95 in microfiche. New Mexico Water Resources Research Institutes, Report No. 9, 1970. 38 p, 1 fig, 43 tab, 26 ref, 1 append. OWRR B-006-NMEX (3) and B-011-NMEX (1).

Descriptors: *Evaporation control, *Transpiration control, *Cost-benefit analysis, Evapotranspiration, Phreatophytes, Water yield improvement, Reservoir evaporation, Economic feasibility, New Mexico, Watersheds (Basins), Monomolecular films, Economics, Water resources, Water supply, Tamarisk, Model studies.
Identifiers: *Evaporation reduction, *Transpiration reduction, *Pecos River Basin, Phreatophyte eradication, Phreatophyte model, Potential evapotranspiration, Water supply augmentation, Vegetation treatment, Monolayer films, Salt Cedar.

A hydrologic model was developed for the Pecos River Basin in New Mexico to estimate the additional water that could be obtained by vegetation treatment in the forested headwater areas, by removing phreatophytes in the lower river valley, and by applying monolayer films on the major reservoirs in the Pecos Valley. The cost and benefits attributable to the increase in water supplies estimated by the hydrologic model were analyzed to determine the economic feasibility of such a program. Results of this analysis were that removal of timber from the forested headwater region of the Pecos watershed would increase the water yield by about 15 percent, but was currently unfeasible because the recreational value of the forest far exceeded the value of the additional water. The results also indicated that the annual water gain of 70,000 acre-feet from the eradication of phreatophytes in the Pecos Valley justified the cost of their removal, and that suppression of evaporation on reservoirs during late summer and fall was feasible in the Pecos Valley and would yield approximately 4,000 acre-feet of water annually. (Creel-New Mexico)
W72-03768

3C. Use of Water of Impaired Quality

THE SUBTERRANEAN WATERS OF TENERIFE: II. STUDIES ON THE USE OF BICARBONATE WATERS,
Centro de Edafologia y Biologia Aplicada de Tenerife (Spain).
E. Fernandez, Caldas, V. Perez Garcia, and A. Borges Perez.
An Edafol Agrobiol. 29 (3/4): 193-207. Illus. 1970. English summary.
Identifiers: Alkalinity, Banana-M, Bi, Carbonate, Irrigation, pH, Salinity, Soil, Spain, Subterranean, Tenerife.

The bicarbonate rich waters used for irrigation in banana plantations do not result in the formation of saline or alkaline soils. The pH and Na adsorption of the soil are affected. The carbonates and bicarbonates of the waters of irrigation have not materially contributed to increasing the percentage of exchangeable Na in the soils studied. Frequent heavy irrigations with water are an effective measure for the control of salinity and alkalinity of the soils. The addition of organic material improves the hydraulic permeability of the soil and leaching.--Copyright 1971, Biological Abstracts, Inc.
W72-03802

SUTDIES ON THE PRODUCTIVITY OF VEGETABLE CROPS UNDER PLASTIC GREENHOUSE: THE MOVEMENT OF WATER--SOLUBLE SALTS IN SOILS,
Ministry of Agriculture and Forestry, Shizuoka (Japan). Horticulture Research Station.
Mikiyo Kageyama, and Takashi Masaki.
Bull Hort Res Sta B (Okitsu). 8. 27-42. Illus. 1968. In Japanese and English summaries.
Identifiers: Accumulation, Crops, Evaporation, Frequency, Greenhouse, Irrigation, Movement, Plastic, Productivity, Salts, Soils, Soluble, Under, Vegetable.

The total amount of water applied to the soil increased as the amount of water/irrigation in-

creased. Water soluble salts were mostly near the soil surface (0-5 cm deep); the total salt concentration was high especially at the center of a ridge when the amount of irrigation was small. With a high concentration of water soluble salts in soil, the salts accumulate near the surface with improper irrigation; thus inhibiting plant growth. When N was applied, the electrical conductivity of the surface soil solution increased with time; that of the deeper layer decreased rapidly with increased application of N. The accumulation of water soluble salts seemed to result primarily from the upward capillary movement of water and subsequent evaporation. Although the electrical conductivity was considerably higher at the soil surface after incomplete plowing, it was smaller at the surface and higher in the deeper layer than with unplowed soil.--Copyright 1971, Biological Abstracts, Inc.
W72-03803

RECLAMATION OF THE BRACK ALLUVIAL SOILS OF RIET RIVER USING THE THRESHOLD CONCENTRATION CONCEPT,
Agricultural Research Inst., Glen (South Africa).
For primary bibliographic entry see Field 02G.
W72-03806

3D. Conservation in Domestic and Municipal Use

MANAGEMENT PROBLEMS IN METROPOLITAN WATER RESOURCE OPERATIONS,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 06B.
W72-03553

METROPOLITAN SUCCESSIVE USE OF AVAILABLE WATER,
Colorado Univ., Boulder. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 05D.
W72-03616

WE ARE NOT RUNNING OUT OF WATER,
For primary bibliographic entry see Field 05D.
W72-03651

ECONOMIC ANALYSIS OF PUBLIC WATER SUPPLY IN THE PISCATAQUA RIVER WATERSHED,
New Hampshire Univ., Durham. Water Resources Research Center.
For primary bibliographic entry see Field 06B.
W72-03764

IDENTIFICATION OF MANAGEMENT AND PLANNING PROBLEMS OF URBAN WATER RESOURCES IN THE METROPOLITAN AREA OF GREATER SAN ANTONIO,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 06B.
W72-03930

MULTI-ORGANIZATIONAL DECISION PROCESS IN THE PLANNED EXPANSION OF TOWNS,
Institute for Operational Research, London (England).
For primary bibliographic entry see Field 06B.
W72-03952

COMMUNITY WATER PROBLEMS AS A FACTOR IN MUNICIPAL INCORPORATION IN MONTANA,
Montana Univ., Missoula.
For primary bibliographic entry see Field 06E.
W72-03956

3F. Conservation in Agriculture

EVALUATION AND FUNCTIONAL OPERATION OF IRRIGATION SYSTEMS,
South Dakota State Univ., Brookings. Water Resources Inst.
Delvin D. Brosz, and John L. Wiersma.
Available from the National Technical Information Service as PB-206 124, $3.00 in paper copy, $0.95 in microfiche. Completion Report December 1971. 34 p, 13 fig, 4 tab, 17 ref. OWRR A-017-SDAK (1).

Descriptors: *Irrigation engineering, *Evapotranspiration, *Furrow irrigation, *Irrigation practice, *Irrigation systems, *Irrigation design, Irrigation programs, Irrigation efficiency, Irrigation water, Irrigation operation and maintenance, Hydrologic budget, Consumptive use, Water delivery, Water distribution, South Dakota, Soil moisture.
Identifiers: *Irrigation scheduling, *Cut-back furrow irrigation.

A procedure was developed whereby irrigators could use weekly mean values of daily evapotranspiration to schedule irrigations and to determine the quantity of water to apply. The weekly mean values of daily evapotranspiration were calculated for corn and alfalfa crops in South Dakota on an area basis using the Jensen and Haise potential evapotranspiration equation. Daily soil moisture balance was estimated, using the calculated values, for irrigated fields on several farms by a water balance technique. The soil moisture balance estimates were compared against actual soil moisture balance measurements. The comparisons indicate that the calculated weekly mean values of daily evapotranspiration are reliable and reasonably accurate for soil moisture level estimation. An automatic cut-back surface irrigation system using controlled pressure regulating valves and bored nonregulating outlets was also studied. A laboratory evaluation was made of the discharge characteristics for the bored outlets as a function of velocity past the outlet and static head. Results show that a regulating valve can control the rate of discharge for an initial and cut-back rate within plus or minus 5 percent of a design rate. One design of the system was field tested and an average application efficiency of 86 percent and a distribution efficiency of 77 percent was attained for the trials.
W72-03532

BACTERIAL QUALITY OF IRRIGATION CANAL WATERS IN THE AGRICULTURAL-URBAN COMPLEX OF THE SALT RIVER VALLEY, ARIZONA,
Arizona State Univ., Tempe.
For primary bibliographic entry see Field 05G.
W72-03612

FOOD, FIBER AND THE ARID LANDS.
Arizona Univ., Tucson. Office of Arid-Lands Research.

University of Arizona Press, Tucson, Arizona, 1971. 437 p. Editors: William G. McGinnies, Bram J. Goldman, Patricia Paylore.

Descriptors: *Arid lands, *Agriculture, *Irrigation practices, Irrigation efficiency, Social aspects, Political aspects, Crops, Food chains, *Food habits, *Fiber crops, Land Management.

Individual papers grouped under five headings: Part I, Cultural and Social Problems; Part II, Land and Resource Uses; Part III, Water and Agriculture; Part IV, Ecology of Arid Regions; and Part V, Information Sources. (See also W72-03653 thru W72-03675)
W72-03652

SOCIAL AND INSTITUTIONAL OBSTACLES TO AGRICULTURAL DEVELOPMENT OF ARID LANDS IN THE MIDDLE EAST,
Resources for the Future, Washington, D.C. Land Use and Management Program.
M. Clawson.
In: Food, Fiber, and the Arid Lands, p 3-15, University of Arizona Press, 1971. 1 fig, 2 tab, 92 ref.

Descriptors: *Arid lands, *Agriculture, *Irrigation systems, *Land management, *Foreign countries, Soil salinity, Grazing, Crops, Irrigation practices, Dams, Social aspects, Political aspects, Fallowing, Water resources development, Developed waters, Economic feasibility, Planning, Education, Investment.
Identifiers: *Middle East, *Developing countries.

It is estimated that in the Middle East, there are about 8 million hectares of reasonably irrigable land that might be developed at tolerable cost and about 10 million acres of rainfed arable lands capable of economic crop production. The major areas of irrigable land are in the Nile Valley and the Mesopotamian Plain. The Nile Valley has many problems due to the construction of the Aswan Dam, but its agricultural potential is enormous. Salinity has not yet become a problem, but probably soon will, because of drainage problems. Although the cost of reclamation will be high, it is economically possible. Rainfed arable lands are suffering from underproduction due to traditional and inefficient practices and grazing and forage lands have been overexploited. Modern land use programs should upgrade the productivity of both. The major developmental obstacles in these regions are ineffective and unstable political situations, lack of transportation and marketing facilities, inefficient traditional practices, obsolete land-ownership patterns and lack of investment capital. Development efforts should concentrate on a few high-potential areas, rather than overextension into many regions. (See also W72-03652) (Casey-Arizona)
W72-03653

RESOURCE-ALLOCATION PROBLEMS FOR THE DEVELOPMENT OF ARID ZONES,
United Nations Education, Scientific and Cultural Organization, Paris (France). United Nations Development Programme.
M. A. Max-Neef.
In Food, Fiber and the Arid Lands, p 17-38, 1971. 2 fig, 68 ref.

Descriptors: *Arid lands, *Investment, *Resource allocation, *Water resources development, History, Decision making, Economic feasibility, Social aspects, Planning, Intangible benefits.
Identifiers: *Developing countries.

Many of today's deserts were flourishing meadows during the life spans of ancient civilizations. Ancient irrigation systems, such as those of the Incas, were models of highly complicated hydraulic engineering. These ancient desert cultures had 2 things in common: water consciousness and great capacities to develop the limited potentials of the desert to their fullest. From these achievements arose some of the world's greatest civilizations. The goal of resource allocation theory is to choose only those investments that will result in an optimal impact on the developmental process. An extensive review of traditional concepts concerning development and investment lead to the conclusion that arid lands development would have to be rejected by many of these criteria, although the accomplishments of the ancients would seem to bely this. A set of criteria are therefore proposed, specifically designed for arid zones. The fundamental criterion is that no isolated investment project can be planned without simyltaneous consideration of all the necessary inter-related service projects required for its maintenance. Investment goals should be the highest growth rates over time, which can only be achieved by widespread par-

ticipation of the populace. Therefore symmetric income distributions are also a necessary goal. (See also W72-03652) (Casey-Arizona)
W72-03654

ARID LANDS AGRICULTURE AND THE INDIANS OF THE AMERICAN SOUTHWEST,
Arizona Univ., Tucson. Office of International Programs; and Arizona Univ., Tucson. Dept. of Anthropology.
J. E. Officer.
In: Food, Fiber and the Arid Lands, p 47-77, University of Arizona Press, 1971. 1 fig, 8 tab, 53 ref.

Descriptors: *Indian reservations, *Water rights, *Federal jurisdiction, *Social aspects, Irrigation programs, Southwest U.S., Colorado River, Irrigation water, Grazing, Crops, Political aspects, Planning, Economic justification, Federal project policy, Legal aspects, Land tenure, History.
Identifiers: *Indian water rights, *Indian agricultural potential.

Southwestern Indian reservations are substantial producers of food and fiber, and as a group, have an enormous potential for much greater production. Because of a combination of factors, however, some related to Indian culture, but most to the unique reservation system dominated by the federal government, the potential of these Indian lands has been massively underexploited. The critical factors include the imposition on certain reservations of the land allotment system, and its attendent problems of fractionated ownership, the failure of the federal government to honor its promises of irrigation projects and other needed reservation facilities, slowness of the federal government in facilitating resolution of Indian reservation ownership and other equally basic questions, Indian inability to obtain credit, and the failure of unimaginative tribal governing bodies to resolve critical internal problems. The history of irrigated agriculture and grazing is reviewed for major southwestern reservations. In almost every case, grand irrigation projects mostly planned by the government, have suffered from incompetent construction, inadequate congressional appropriations and failure to provide adequate water use institutions. Even the Colorado River reservation, by far the most water-rich of all with adjudicated rights to over 100,000 acres, has developed barely 1/2 its potential. Many of the non-physical factors inhibiting Indian agricultural progress are similar to those in rural Mexico and Maori reservations in New Zealand. (See also W72-03652) (Casey-Arizona)
W72-03655

THE PAPAGO CATTLE ECONOMY: IMPLICATIONS FOR ECONOMIC AND COMMUNITY DEVELOPMENT IN ARID LNDS,
Papago Office of Economic Opportunity, Sells, Ariz.
R. W. Bauer.
In: Food, Fiber and the Arid Lands, p 79-102, University of Arizona Press, 1971. 3 fig, 3 tab, 31 ref.

Descriptors: *Indian reservations, *Water resources development, *Social aspects, *Cattle, *Economic impact, Political aspects, Human populations, Arid lands, Federal government, Planning, Water users, Soil erosion, History.

The Papago Indians of arid southern Arizona have lived in peace with the Spaniards, the Mexicans and finally the Americans. Since the introduction of the horse and cow by the Spaniards, the Papagos gradually evolved a pastoral culture. The creation of the huge Papago reservation and the subsequent history of dealings between the Indians and government agents furnishes a picture of the problems of enclave groups in arid regions. Since the Indian Service began developing the Papago cattle economy, there have been 3 periods of intensive water development on the reservation through 1958. The final result of the early water resources developments were severe overstocking resulting in much erosion and general range degradation. Since then the Indian Service has attempted to convince the Papagos that a reduction of the number of range cattle together with rational water development projects and cattle breeding programs would be necessary. A detailed history is presented of federal programs for each of these objectives. Most have failed, some were partially successful and a few were very successful. The Papagos, for cultural reasons, were reluctant to reduce their cattle numbers and resisted many of the development projects because of mistrust of the government's motives. Slowy the government people learned to involve the Indian in the project and to stand aside as advisers only. (See also W72-03652) (Casey-Arizona)
W72-03656

BUILDING DESIGN AND PLANNING FOR SELF-SUSTAINING COMMUNITIES IN REMOTE LOCALITIES OF AUSTRALIA'S ARID ZONE,
Melbourne Univ., Parkville (Australia). Dept. of Architecture and Building.
B. S. Saini.
In: Food, Fiber, and the Arid Lands, p 103-122, University of Arizona Press, 1971. 25 fig, 11 ref.

Descriptors: *Aird lands, *Water cooling, *Human population, *City planning, *Community development, Drainage systems, Economics, Roads, Urban development, Social aspects, Planning, Water resources development, Vegetation effects, Foreign lands, Buildings, Heat transfer.
Identifiers: *Australia, *Evaporative coolers, *Housing developments, *Physical comfort.

Many small towns have arisen in the hot, arid interior of Australia, and are mainly connected with mining activities. Looking at population distribution, labor turnover, and employment patterns, it appears that, in spite of many excellent amenities such as air conditioning, an unusually large number of people are dissatisfied with their lot in these towns. By contrast, no such problem seems to exist with pastoral families, whose adaptability is reflected by their contentment with clusters of tin sheds and weird outbuildings that confer little physical comfort. The author contends that realistically comfortable housing and a good physical environment would attract and keep new settlers. For instance, the use of air conditioning for physical comfort involves great expense and cuts the occupants off from the outdoors, making them virtual prisoners in their dwellings. A possible better solution is partial treatment such as an air-circulating fan, attic fan or evaporative cooler. Evaporative coolers used successfully in many areas, involve lower capital costs, and require less skilled maintenance. Buildings should reflect sunlight, be constructed of low heat-conductive materials, and include structures providing shade. Open water in pools or sprays would be an important outdoor amenity, as would heat-shielding vegetation. Finally, land subdivision should not encompass large open spaces but should be reasonably compressed for social and upkeep reasons. (See also W72-03652) (Casey-Arizona)
W72-03657

INTERNATIONAL TRAINING: THE INTERAMERICAN CENTER FOR LAND AND WATER RESOURCE DEVELOPMENT: A CASE STUDY,
Utah State Univ., Logan. International Programs and Studies.
B. H. Anderson.
In: Food, Fiber, and the Arid Lands, McGinnies, p 123-136, University of Arizona Press, 1971. 4 fig, 5 tab, 6 ref.

Descriptors: *Water resources development, *Schools (Education), *Training.
Identifiers: *International cooperation, *Organization of American States.

The Interamerican Center for Land and Water Resource Development (CIDIAT) is a project of the Program of Technical Cooperation of the Organization of American States. The government of Venezuela and the Universidad de los Andes at Merida, Venezuela are hosts and cosponsors. Utah State University is the active advisory agent because of its impressive accomplishments and rich background in land and water problems. The history of the development of the Center, the details of the agreements between the OAS and the 2 universities, criteria of faculty and student selection, and program formulation and evaluation are all discussed. The major goal of CIDIAT is to provide Latin American students with a learning experience in harmony with modern development problems. Three basic courses keyed to the background, training and job experience of the participants are developed. These have been supplemented by special regional and national training programs. An experimental course in executive managerial training and a course in operation and maintenance of irrigation districts are described. The accomplishments of the Center are evaluated and future directions are discussed. (See also W72-03652) (Casey-Arizona)
W72-03658

APPLICATIONS OF REMOTE SENSING TO ARID-LANDS PROBLEMS,
California Univ., Berkeley. School of Forestry and Conservation.
R. N. Colwell, and D. M. Carneggie.
In: Food, Fiber, and the Arid Lands, p 173-186, University of Arizona Press, 1971. 5 fig, 12 ref.

Descriptors: *Aerial photography, *Remote sensing, *Infrared radiation, *Arid lands, *Resources, Surveys, Aircraft, Cameras, Mapping, Satellites (Artificial), Terrain analysis, Arizona, Land appraisal, Topography, Water resources, Streams, Vegetation.

Because of the world's increasing population, heavy pressures have been exerted on arid lands productivity. In order to manage and properly exploit these regions, resource surveys are badly needed. The most appropriate type of resource survey seem to be remote sensing from aircraft or spacecraft because of their speed and efficiency. Fortunately, this type of survey is most applicable to arid lands because of their relatively cloud-free conditions. In reviewing the specifications of remote sensing and the type of information desired, it is concluded that the best technique is multi-stage, multi-spectral sampling utilizing aircraft, spacecraft and ground observers. The characteristics of Infrared Ektachrome film are discussed, and a photointerpretation key of the following major land-use categories is presented: urban lands, agricultural croplands, uplands, rangelands, bottomlands (stream channels and washes) and salt flats. Photographs of the Phoenix, Arizona area are included to illustrate these categories as are large-scale aerial photographs to illustrate the problems of vegetation identification by subsampling. The method confers progressively smaller looks at a progressively smaller area and progressively more detailed information about that area. (See also W72-03652) (Casey-Arizona)
W72-03659

THE GOBI DESERT OF MONGOLIA: GEOGRAPHIC DESCRIPTION AND PROSPECTS FOR LAND USE ON THE BASIS OF SOIL, VEGETATION, HYDROLOGY, AND CLIMATE,
Polish Academy of Sciences, Warsaw. Inst. of Geological Science.
J. Lefeld.
In: Food, Fiber, and the Arid Lands, p 187-210, University of Arizona Press, 1971. 20 fig, 3 tab, 35 ref.

Descriptors: *Land appraisal, *Climatic data, *Grazing, *Arid lands, Vegetation, Groundwater basins, Goats, Sheep, Cattle, Human populations, Temperature, Foreign lands, Semiarid climates,

Soil types, Geographical regions, Land management, Water resources development, Permafrost, Geomorphology.
Identifiers: *Mongolian People's Republic, *Camels.

The climates, soils, vegetation, geomorphology and current land uses of the Gobi Desert of Outer Mongolia are reviewed and recommendations are made for exploitation of certain regions. Because the Gobi is surrounded by high, long mountain chains, is 650 km from the nearest ocean and has an altitude range of 800-1100 m above sea level, it receives very little precipitation and is generally characterized by an extreme continental climate. Additionally, the presence of the South-Siberian high-pressure anticyclone in Northern Mongolia strongly influences winter climate and an extreme southern extension of the permafrost zone. The Gobi Desert within the boundaries of the Mongolian People's Republic may be divided into 4 subregions, of which only 1, the southerly Trans-Altay Gobi is true desert, the others being subdeserts. The Great Lakes area, the Ubsa Nur and Khirgis depressions and Shargin Gobi are described in detail, because all of these areas are promising for future exploitation. In every case, the only water source is groundwater, but this seems more than adequate. The Trans-Altay Gobi does not seem promising for exploitation, at least in the near future. The following maps are presented for the entire nation: mean January and July temperatures, mean annual precipitation, vegetation cover, soils, Bactrian camel, sheep, goat, cow and human population distributions. (See also W72-03652) (Casey-Arizona)
W72-03660

PASTURES AND SHEEP PRODUCTION IN THE ARID ZONE OF THE SOVIET UNION,
Desert Inst., Ashkhbad (USSR).
N. T. Nechayeva.
In: Food, Fiber, and the Arid Lands, p 211-216, University of Arizona Press, 1971. 2 fig, 12 ref.

Descriptors: *Watershed management, *Sheep, *Arid lands, *Grazing, *Pasture management, Water resources development, Aqueducts, Groundwater, Rotations, Vegetation effects, Economic impact.
Identifiers: *U.S.S.R., *Camels.

Natural desert forage resources play an enormous role in the Soviet economy, and this reflected in the high development of the sheep industry. In fact, Karakul sheep production is so highly developed in some desert regions that it successfully competes with such highly remunerative agricultural activities as cotton growing. Because of much research, and the application of rational land use policies, the natural vegetation is very effectively used, but some unutilized reserves still remain. An extensive survey of these regions was recently completed, involving pasture water supplies, resource estimates, procured feed provision and pasture improvements. If grazing intensity is controlled, appropriate rotations instituted and supplemental feeds provided, the Karakul sheep population may be increased by 30%. Pasture yield forecasting techniques are rapidly improving and pasture improvement programs may result in productivity increases of 2-5 times. In certain regions, combined sheep and camel grazing may provide maximum yields. Some 45 million hectares should be provided with more or better water. It has been found that large lenses of fresh water from rapidly after reservoir construction and that stable deep wells, artificial watershed construction and aqueducts are practical. (See also W72-03652) (Casey-Arizona)
W72-03661

RANGE-CATTLE PRODUCTION UNDER DRY, WARM CONDITIONS,
Arizona Univ., Tucson. Dept. of Animal Science.
C. B. Roubicek, and D. E. Ray.
In: Food, Fiber, and the Arid Lands, p 217-234, University of Arizona Press, 1971. 3 fig, 3 tab, 58 ref.

Descriptors: *Cattle, *Breeding, *Animal physiology, *Arid lands, *Heat resistance, Drought tolerance, Reproduction, Moisture stress, Water balance, Environmental effects, Metabolism, Grazing, Mode of action, Nutrient requirements, Evaporation.
Identifiers: *Genetic programs, *Thermoregulation, *Cutaneous evaporation, *Endocrine function.

Most improved cattle breeds have been developed in temperate regions and are essentially cold-adapted animals. The productivity of such stocks tends to decrease with increasing environmental temperatures above 30 deg C, because of the high heat load imposed on the animal. Lack of potable water and food shortages are also problems. The most critical result is decrease in reproductive efficiency. The development of a productive breed under such conditions depends on a thorough understanding of the physiological mechanisms of heat tolerance and their response to artificial selective pressures. Efficient thermoregulation in cattle, the external factors of cutaneous evaporation and protective hair coat and the internal factor of endocrine function mediating metabolic rate and other physiologic responses. The effects of heat on thyroid function, adrenal glands, pituitary function, and cathecholamine and corticosteroid levels are discussed. Direct and indirect effects on reproductive functions also occur and include puberty, estrus, gametogenesis, fertilization, embryonic survival, gestation, parturition, neonatal survival and libido. Suitable drinking water is often rare in the desert and dehydration results in declined food intake and homeothermy imbalance, which are exaggerated by saline or alkaline drinking water. In breeding programs, reproductive efficiency is critically important. Selection response to all traits will be maximal if concurrent range improvements to lessen stress conditions is also undertaken. (See also W72-03652) (Casey-Arizona)
W72-03662

SHRUB PRODUCTIVITY: A REAPPRAISAL OF ARID LANDS,
Texas Tech Univ., Lubbock. Dept. of Biology; and Utah State Univ., Logan. Dept. of Range Service.
J. R. Goodin, and C. M. McKell.
In: Food, Fiber, and the Arid Lands, p 235-246, University of Arizona Press, 1971. 6 fig, 2 tab, 48 ref.

Descriptors: *Xerophytes, *Productivity, *Soil-water-plant relationships, *Shrubs, *Land management, Drought tolerance, Plant root systems, Metabolism, Plant physiology, Competition, Soil moisture, Arid lands, Saline soils, Salt tolerance, Grazing, Nutrients, Seasonal, Environmental effects, Mode of action.
Identifiers: *Soil water potential, *Plant water potential, *Plant palatability.

Attempts at establishment of perennial grasses in arid regions often fail as a result of environmental harshness. Such regions usually have extensive stands of native shrubs, and it appears that under severe moisture conditions, deep-rooted shrubs offer a higher potential for productivity than does grass. For a variety of reasons, shrub productivity estimates are difficult to obtain. However, a number of studies are reviewed indicating that it may be quite significant. Research on 3 California Atriplex species showed yields as high as 10,000 kgm dry wt/ha/growing season. Much of the advantage of native shrubs is that they evolved under selection for survival efficiency under extreme conditions rather than high productivity. Such plants are therefore more efficient at utilizing available soil water, growing and reproducing under high moisture stresses and surviving under extreme moisture stresses. Additionally, many posess high salinity and alkalinity tolerances. The various mechanisms by which this is accomplished are reviewed. Successful competitors are those most efficient at obtaining critical environmental elements at the same time they are being withdrawn by other plants. Most desert shrubs are in this category, while many crop plants are not. Studies are needed on nutritive qualities, palatability and life cycles of such shrubs. Management programs should emphasize selection for the productively higher quality shrubs, efforts at replacing lower quality shrubs and reasonable grazing pressures. (See also W72-03652) (Casey-Arizona)
W72-03663

ECONOMIC BOTANY OF ARID REGIONS,
Inter-American Geodetic Survey, Fort Clayton, Canal Zone. Natural Resources Div.; and Inter-American Geodetic Survey, Tucson, Ariz. Natural Resources Div.
P. C. Duisberg, and J. L. Hay.
In: Food, Fiber, and the Arid Lands, p 247-270, University of Arizona Press, 1971. 2 fig, 1 tab, 15 ref.

Descriptors: *Xerophytes, *Arid lands, *Economic feasibility, *Research and development, History, Plants.
Identifiers: *Economic botany.

Primitive peoples of the deserts have always existed in harmony with their environment, partly be extensive utilization of native plant products. In the past few decades, the combination of rising aspirations and outmigrations of desert peoples together with synthetic substitutes have dimmed the prospects of arid region economic botany. Much of the problem lies with the plant-industries themselves, who have not used systematic scientific evaluation techniques, although a start has been made by the U.S. Department of Agriculture New Crops Program. Such a neglect of desert plant potentials can only be afforded by the more affluent coutries with arid zones. In the underdeveloped countries where no resource can be ignored, research in this area may be critically important. In Mexico, a country with an important tradition of desert plant use and desert plant industries, much important research, though inadequately funded, goes on. The economic history and future prospects of many plants are discussed. An extensive appendix is included containing a partial listing of economic desert plants and provides information of known uses of these plants. (See also W72-03652) (Casey-Arizona)
W72-03664

SOIL MANAGEMENT: HUMID VERSUS ARID AREAS,
Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils.
T. C. Tucker, and W. H. Fuller.
In: Food, Fiber, and the Arid Lands, p 271-286, University of Arizona Press, 1971. 12 fig, 58 ref.

Descriptors: *Soil types, *Soil management, *Soil-water-plant relationships, *Arid lands, *Soil structure, Soil water movement, Humid areas, Saline soils, Soil texture, Irrigation practices, Plant growth, Nutrients, Salts, Decision making, Organic matter.

In arid and subhumid areas, the key to the maintenance of a stablized agriculture is proper soil and water management with attention to infiltration percolation, aeration, salt balance, drainage control of salt balance within the root zone and plant-water interrelationships. Good soil management becomes a series of decisions relative to the sum total of all controllable crop-production factors. General soil problems of both humid and arid soils are identified and the contributing factors are analyzed in order to facilitate input for decision making. In humid regions where soil organic matter is high, it has been used almost as a standard in evaluating soil fertility. In many arid soils, however, where soil organic matter is notoriously

low, productivity is extremely high, indicating the importance of turnover rather than absolute abundance. Soil acidity is a problem in humid regions while accumulations of excess salts and toxic ions requiring leaching and other reclamation practices plague arid soils. Many problems relating to soil structure, irrigation water quality and plant nutrients are considered in detail. In all cases, the primary consideration is the inherent capability of the basic resource--soil. (See also W72-03652) (Casey-Arizona)
W72-03665

EXPLOITATION OF GROUNDWATER FOR AGRICULTURAL PRODUCTION IN ARID ZONES,
Food and Agriculture Organization of the United Nations, Rome (Italy). Land and Water Development Div.
D. J. Burdon.
In: Food, Fiber, and the Arid Lands, p 289-300, University of Arizona Press, 1971. 4 tab, 31 ref.

Descriptors: *Arid lands, *Groundwater, *Irrigation practices, *Exploitation, *Salinity, Saline soils, Saline waters, Evapotranspiration, Drainage practices, Aquifers, Semiarid climates, Water users, Water resources development, Stock water, Water quality, Research and development.

The sources of groundwater beneath deserts and semideserts may vary in both time and space. It may have been deposited in past pluvial periods, be derived from some distance away in more humid areas or it may be a result of recharge from the infrequent desert precipitation. The main uses of groundwater in arid and semiarid regions are: (1) irrigation of oases and riverine alluvia, (2) stock watering, (3) water for transdesert movement. For transdesert movement, groundwater is usually the only water source, is developed cheaply and presents no problems. In the other categories, problems are presented and these are outlined together with probable solutions and alternate uses. Modern groundwater development may often present extreme technical problems to desert natives both in terms of withdrawal installations and the subsequent withdrawals. Problems of location, development and extraction of groundwater are discussed. Groundwater irrigation in arid regions is usually complicated by high evapotranspiration, drainage, water quality, recirculation and falling water tables. This usually leads to salinity problems which are extremely serious. It is felt that not only must modern safeguards be used, but rational studies also be made in order to determine possible more productive alternate uses. Major projections by international agencies concerning future groundwater developments in irrigation and stock watering are discussed. (See also W72-03652) (Casey-Arizona)
W72-03666

WATER CONSERVATION FOR FOOD AND FIBER PRODUCTION IN ARID LANDS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
L. E. Myers.
In: Food, Fiber, and the Arid Lands, p 301-309, University of Arizona Press, 1971. 28 ref.

Descriptors: *Water supply, *Irrigation efficiency, *Water loss, Groundwater, Diversion, Seepage, Evaporation, Waste water disposal, Dew, Desalination, Runoff, Irrigation practices, *Water conservation.
Identifiers: *Irrigation scheduling.

Ancient men in deserts usually adjusted their water needs in accordance with available supply. Modern man has shown very little-restraint, concentrating on increasing water supplies to meet his accelerating demands. Streamflow diversion and groundwater pumping are the most common modern desert water sources but each is facing mounting problems, which are political with respect to diversion and too-rapid depletion with pumping. Fortunately they are not the only available water sources. It is felt that more use must be made of current technological potentials as well as imaginative, futuristic research in desalination and precipitation inducement together with ancient, proven methods such as horizontal wells (qanats) and runoff farming through the construction of microcatchments. The use of dew and fog condensation methods seems impractical because water yield is too low. Wastewater reuse is promising but threatened soil salinity buildup renders it impractical on a large scale until economic desalination methods are available. Soil treatments to increase runoff seem extremely promising. The use of more efficient water distribution systems in irrigation combined with efficient irrigation scheduling and minimum percolation and leaching losses must be accomplished. Water losses by seepage and evaporation from soil and water surfaces also holds much promise. Plants must be bred for greater water-use efficiency and photosynthetic efficiency. (See also W72-03652) (Casey-Arizona)
W72-03667

RUNOFF AGRICULTURE IN THE NEGEV DESERT OF ISRAEL,
Hebrew Univ., Tel-Aviv (Israel). Dept. of Botany.
M. Evenari, L. Shanan, and N. H. Tadmor.
In: Food, Fiber, and the Arid Lands, p 311-322, University of Arizona Press, 1971. 16 fig, 6 tab, 18 ref.

Descriptors: *Water yield improvement, *Arid lands, *Runoff, *Farms, *Hydrologic data, Water conservation, Floods, Cultivated lands, Land management, Irrigation systems, Vegetable crops, Pastures, Fruit crops, Leaching.
Identifiers: *Runoff farming, *Microcatchments.

The ruins of large ancient cities in the Negev Desert, which today has no permanent surface waters or underground water supply, imply either that past climate was different or that the ancient farmers had devised intensive desert farming techniques that were highly productive. Two ancient desert farms were reconstructed in an area of 80-100 mm rainfall/year for the purpose of testing the climatic change hypothesis, determining whether the ancient farming methods (runoff farming) would work today, collecting areal hydrologic data and analyzing rainfall-flood relationships and determining water use efficiencies and drought resistance of various cultivated plants under runoff farming conditions. Microcatchments were rebuilt, hydrologic data collected and fruit trees, pasture plants, field crops and vegetables were planted. The results were: (1) microcatchments (0.1 ha) with a cultivated field size to catchment area size ratio of 1:30, and cleared of stones, yielded enough runoff water to ensure good growth and adequate yields of cultivated crops; (2) most of the fruit trees proved astonishingly drought resistant yielding well with very little water; (3) the yields of the more successful pasture plants increased with more water although their water use efficiencies decreased; (4) the most successful vegetable crop was asparagus. The results indicate that it is not necessary to postulate past climatic changes. (See also W72-03652) (Casey-Arizona)
W72-03668

ARTIFICIAL INDUCEMENT OF RUNOFF AS A POTENTIAL SOURCE OF WATER IN ARID LANDS,
Hebrew Univ., Jerusalem (Israel).
D. Hillel.
In: Food, Fiber and the Arid Lands, p 323-330, University of Arizona Press, 1971. 3 fig, 22 ref.

Descriptors: *Runoff, *Water yield improvement, *Arid lands, *Soil treatment, *Infiltration, Soil water movement, Vegetation effects, Excess water (Soils), Hydrologic data, Rainfall, Surface waters, Water conservation, Economic feasibility.
Identifiers: *Runoff farming.

Water harvesting, or runoff inducement, may yield benefits greater than the mere increase in runoff that it may produce. Effective increases in runoff may decrease runoff threshold thereby increasing adequate seasonal runoff possibilities. Runoff utilization is a very old art in desert regions. Ancient Negev farmers not only attempted to utilize runoff but also attempted to induce more of it by clearing slopes of gravel and rock in order to facilitate crust formation. For a given rainfall, runoff is a function of surface storage capacity and infiltration rate. Surface storage may be reduced by smoothing the land surface. Recent developments in the theory of infiltration now permit calculation of relative infiltrability for various types of surface. It is not merely enough to smooth and seal the surface for runoff inducement: it is also necessary to stabilize the surface to minimize destructive erosion. Studies point to the following methods for treating arid zone soils to collect runoff: (1) vegetation eradication and surface stone removal which reduces rain interception and flow obstruction and permits the formation of a continuous crust; (2) smoothing the land surface to obliterate depression and prevent puddling; (3) compaction of the top soil layer to reduce permeability; (4) dispersion of soil colloids to induce self-crusting; (5) surface impregnation with water-repellent materials. (See also W72-03652) (Casey-Arizona)
W72-03669

THE PROTOPLASMIC BASIS FOR DROUGHT RESISTANCE: A QUANTITATIVE APPROACH FOR MEASURING PROTOPLASMIC PROPERTIES,
Minnesota Univ., St. Paul. Dept. of Horticultural Science.
E. J. Stadelman.
In: Food, Fiber and the Arid Lands, p 337-352, University of Arizona Press, 1971. 3 fig, 2 tab, 54 ref.

Descriptors: *Moisture stress, *Plant physiology, *Water balance, *Osmotic pressure, Biochemistry, *Drought tolerance, Laboratory tests, Bound water, Enzymes, Solutes, Permeability, Viscosity, Education, Research and development.
Identifiers: *Plant water potential, *Plant cell sap, *Vacuoles, *Protoplasm, *Macromolecules.

Plant drought resistance may take 1 of 2 forms: drought avoidance which involves adjustments of various organ systems, and water stress tolerance, which is a property of the protoplasm, defined as its ability to survive adverse conditions of suboptimal water supply. Water is present in the plant cell at different degrees of mobility. The 2 extremes are vacuolar free water and imbibed (closely bound) water in the protoplasm. Presumably the bound water is associated with macromolecules with the function of maintaining necessary spatial relationships between reactive enzymatic sites. During water stress osmotically active solutes are actively transported from the protoplasm to the vacuolar sap, which equilibrates with the protoplasm until internal osmotic pressure equals external water-withdrawing power. A stress lasting for several days usually results in permanent protoplasmic changes so that the drought tolerance of the plant is subsequently greater. The best measure of water stress is cell osmotic potential, and 2 methods of experimentally determining this parameter are described. Water stress tolerance cannot be directly determined, but it should be reflected in protoplasmic permeability and viscosity, which may be measured. The practical implications of this are discussed and experimental programs with crop plants are proposed. Intensive educational efforts will be necessary to train people qualified to carry out such research. (See also W72-03652) (Casey-Arizona)
W72-03670

SAND-STABILIZATION METHODS IN ARID LANDS: PROTECTION OF AGRICULTURAL AND SETTLEMENT AREAS,
Leningrad State Univ. (USSR). Dept. of Geography.
M. P. Petrov.
In: Food, Fiber and the Arid Lands, p 355-368, University of Arizona Press, 1971. 5 fig, 1 tab, 67 ref.

Descriptors: *Sands, *Dunes, *Arid lands, *Stabilization, *Vegetation effects, Geomorphology, Geographical regions, Semiarid climates, Soil stabilization, Slope stabilization, Consolidation, Wind erosion.

Irrational and destructive human practices in arid and semiarid regions around the world have led to native vegetation destruction and resulted in shifting and deflating sand which in turn wreaked much destruction on human enterprises. The problems of protecting sandy areas from irrational use and stabilization of disturbed areas have therefore received much attention. Vegetative means of effecting stabilization have been quite successful in many areas but not in very arid regions. Worldwide experience in the afforestation and stabilization of such region has been extensive and is reflected in the bibliography which contains references to work done in most arid regions. The chief principle in such projects is to plan revegetation carefully and formulate detailed project methods. Three major types of sandy areas and 8 major groups of vegetation sites are described for the world's deserts. The assortment of effective stabilizing plant species is inversely proportional to aridity. The greatest number may be established in semiarid regions and tree-shrub species are the most effective. A few species of trees and shrubs may be effective in arid areas if protected for 2-5 years. In extremely arid areas only costly physicochemical stabilization methods are possible. Much research and development is still necessary, and this is discussed in some detail. (See also W72-03652) (Casey-Arizona)
W72-03671

STABILIZATION OF SAND DUNES IN THE SEMIARID ARGENTINE PAMPAS,
Instituto Nacional de Tecnologia Agropecuaria, Castelar (Argentina). Centro Nacional de Investigaciones Agropecuarias; and Wisconsin Univ., Milwaukee.
A. J. Prego, R. A. Ruggiero, F. R. Alberti, and F. J. Prohaska.
In: Food, Fiber and the Arid Lands, p 369-392, University of Arizona Press, 1971. 13 fig, 9 tab, 36 ref.

Descriptors: *Vegetation effects, *Dunes, *Semiarid climates, *Sands, *Rainfall, Forest management, Pastures, Climatic data, Plant growth, Trees, Grasses, Research and development, Willow trees, Foreign lands, Wind erosion, Environmental effects.
Identifiers: *Argentina.

Approximately 75% of the area of Argentina suffers from aridity, which intensifies from east to west. The worst problems of wind erosion and sand dune instability occur in the semiarid Pampas which comprises an area of about 22 million ha. This region, because of grain and livestock, is one of the most important socioeconomic regions of the country. Records show that the irreversible destruction of fertile lands has been extensive and serious, with sand dunes as the permanent foci of destruction. An intensive research effort has therefore been necessary and was begun in 1947. An attempt is made to describe synthetically the environmental characteristics, the research accomplished and the results achieved since that time. Seeds of various pasture grasses are used in the fall to successfully stabilize dunes. Ulmus pumila and Eucalyptus viminalis have been used in afforestation and are successful on dunes previously stabilized with pasture. In the western sector of the Pampas, poplars showed good responses, while in the slightly more humid eastern portion Salix hybrids were most successful. Pasture establishment is more complicated than afforestation, but accomplishes dune stabilization in only 3-6 months while trees need 2-3 years. (See also W72-03652) (Casey-Arizona)
W72-03672

EFFECT OF INSECTICIDES ON AN ECOSYSTEM IN THE NORTHERN CHIHUAHUAN DESERT,
Texas Univ., El Paso. Dept. of Civil Engineering; and Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences; and Louisiana State Univ., Baton Rouge. Fisheries Div.
H. G. Applegate, W. Hanselka, and D. D. Culley.
In: Food, Fiber and the Arid Lands, p 393-404, University of Arizona Press, 1971. 5 fig, 7 tab, 18 ref.

Descriptors: *Insecticides, *Animal physiology, *Ecosystems, *Arid lands, *Plant physiology, Ecology, Rainfall, Mammals, Rodents, Cotton, Texas, Mexico, Metabolism, Animal behavior, Ecological distribution, Biological communities, Deserts.

Unfortunately, although pesticides have been extensively studied in mesic regions, there is little data on their effects on arid ecosystems. The Presidio Basin, which lies on the border between southern Texas and Mexico, lies in the Chihuahuan Desert and is relatively isolated from adjoining regions so that insecticides found within the basin are extremely likely to have been applied there. Over a 5-year period, insecticides, mainly DDT and methyl parathion (MP), were studied with respect to their levels in plants and vertebrates. Concentrations and distributions were determined through a 15-km transect originating in a cotton field and included birds, lizards, rodents, jackrabbits, cotton and leatherstem (Jatropha dioica) plants. The data did not indicate any direct insecticide-mortality relationship. Rodents possessing high body levels of MP were recaptured more often and juveniles with high MP levels in the brain died. It was postulated that MP created motor defects mediated by behavioral changes. Insecticide uptake by plants was correlated with rainfall. Dormant plants did not take up insecticides to any appreciable degree. Results were different from those in mesic areas and it is cautioned that comparisons between ecosystems should be made carefully. (See also W72-03652) (Casey-Arizona)
W72-03673

ARID-LANDS INFORMATION IN UNITED STATES GOVERNMENT-SPONSORED INDEXING TOOLS: WHAT. WHERE. WHEN. HOW,
Arizona Univ., Tucson. Office of Arid-Lands Research.
P. Paylore.
In: Food, Fiber and the Arid Lands, p 407-420, University of Arizona Press, 1971. 11 ref.

Descriptors: *Arid lands, *Information retrieval, *Bibliographies, *Computers, *Documentation, Federal government, Abstracts, Publications, Libraries, Education, Scientific personnel.

The information explosion in scientific research has reached nearly unmanageable proportions, swamping the resources of librarians and potential users alike. The computer, however, will probably provide a late-hour rescue as the tremendously impressive computer-produced indexing and abstracting tools proliferating throughout the world would seem to indicate. Now that a larger framework is being established, problems have arisen of creating a greater degree of specificity within that framework, and of finding a pool of qualified scientific personnel capable of evaluating and sorting the existing mass of information. In the U.S., great advances have been achieved mainly by the efforts of several centralized agencies of the federal government. The tools that have been developed have steadily improved in terms of indexing, specificity, recoverability and information content. As an aid to inexperienced librarians and scientific users, the history, evolution and content of the major sources are reviewed in detail. These include: Bibliography of Technical Reports (BTR), U.S. Government Research Reports (USGRR), National Technical Information Service (NTIS), U.S. Government Research and Development Reports (USGRDR), Selected Water Resources Abstracts (SWRA), and others including various translation services. Case studies are used to illustrate techniques and problems in arid lands literature searches. Tables of organizational acronyms and current ordering information are included. (See also W72-03652) (Casey-Arizona)
W72-03674

A REGIONAL BIBLIOGRAPHY OF CALCRETE,
Oxford Univ. (England). School of Geography.
A. S. Goudie.
In: Food, Fiber, and the Arid Lands, p 421-427, University of Arizona Press, 1971. 450 ref.

Descriptors: *Caliche, *Calcium carbonate, *Bibliographies, *Arid lands.
Identifiers: *Calcrete.

Calcrete appears to be the most suitable international term for materials formed by the cementation and possible alteration of pre-existing soil or rock by a material that is predominantly Ca carbonate. It is called caliche in the U.S. and various names in the rest of the world including kunkur, kalkruste, croute calcaire and tosca. It has great areal extent in the arid and semiarid regions of the world although its composition is extremely variable. It is also important in groundwater exploration, mineral prospecting and stratigraphic indication. The bibliography, some 450 citations, is arranged by region. (See also W72-03652) (Casey-Arizona)
W72-03675

ON THE PROGNOSIS OF THE AGRO--METEOROLOGICAL CONDITIONS OF THE WINTERING OF WHEAT AS ONE FACTORS IN THE PREDICTION OF THE CROP,
Hidrometeoroloski Zavod Socijalisticke Republike Bosne i Hercegovine, Sarajevo (Yugoslavia).
Z. Micevic.
Savremena Poljoprivreda, Vol 18, No 3, p 257-265, 1970. 4 tab, 1 fig, 8 ref.

Descriptors: *Analysis, *Wheat, *Forecasting, *Crop production, Winter, Arid lands, Seasonal, Thermal properties, Soil moisture, Experimental farms, Varieties, Meteorological data, Soil temperature, Rainfall, Limiting factors, Climatic data, Radiation, *Soil-water-plant relationships.
Identifiers: *Agri-meteorological conditions, Yugoslavia.

Meteorological factors in fall and spring play an important role in Yugoslavia's total wheat yield. The function of thermic factors and soil moisture as a basis for prediction of wheat yield is investigated. Experiments at 7 meteorological stations using 3 wheat varieties and 6 sowing dates were conducted, where soil moisture and temperature were recorded at various depths. Seasonally important agrometeorological factors are discussed. Yugoslavia experiences maximum rainfall in May-June, with a secondary maximum in October-November, totalling less than 10 inches annually. A basis for the prognosis of winter wheat yield is obtained from climatological and agrometeorological statistical data for temperature, rainfall and soil moisture. Tables show average 10-year air temperature, soil moisture and rainfall, phenological growth of wheat, radiation and temperature effects. A graph summarizes air temperature, rainfall and soil moisture data. (Popkin-Arizona)
W72-03692

SOME TECHNOLOGICAL CHARACTERS OF THE SOVIET BARBADENSE COTTON VARIETIES CULTIVATED UNDER THE CONDITIONS OF THE UAR,
National Research Centre, Cairo (Egypt). Genetics and Cytology Lab.
A. M. Abd-El'Hamid.
Savremena Poljoprivreda, Vol 18, No 4, p 333-336, 1970. 1 tab, 5 ref.

Descriptors: *Crop production, *Cotton, *Varieties, *Breeding, Evaluation, Programs, History, Arid lands, Experimental farms, Technology, Analysis, Length, Fiber crops, Strength, Quality control.
Identifiers: *Cotton lint, *Barbadense cotton, Egypt, Soviet Union, Middle East, Pressley index, Micronaire.

Fine staple cotton varieties of the Soviet Union cultivated under Egyptian environmental conditions are evaluated. The objective was to find useful varieties to be used in cotton breeding programs. A historical review of Barbadense cotton varieties in the Soviet Union and the Middle East is presented. Eleven Soviet cotton varieties and 2 Egyptian varieties were grown in experimental plots. Technological analysis, halo length, Pressley index, micronaire values, lint percentage, and Duncan's new multiple range test were measured or applied. Lint percentage, fiber strength, and fiber fitness are discussed. Some Soviet varieties had a better quality than Egyptian varieties and can be used in cotton breeding programs. Soviet varieties S-6002, 5896-I, and 35-2 were promising. (Popkin-Arizona)
W72-03693

EFFECT OF CCC ON SOME MORPHOLOGICAL AND PHYSIOLOGICAL TRAITS AND YIELD OF WHEAT UNDER A SEMIARID CLIMATE,
Novi Sad Univ. (Yugoslavia). Agricultural Research Inst.
S. Jevtic.
Savremena Poljoprivreda, Vol 18, No 4, p 325-331, 1970. 5 tab, 18 ref.

Descriptors: *Herbicides, *Wheat, *Climatic data, *Plant morphology, *Plant physiology, Chlorides, Plant growth regulators, Crop production, Fertilization, Variability, Experimental farms, Chernozems, Treatment, Weight, Density, Lodging, Precipitation (Atmospheric), Nitrogen, Cultivation.
Identifiers: *Chlorcholinchloride, *Growth retardants, *Yugoslavia, Semiarid lands, Dressing, Stem height, Internode length, Spikes, Kernels.

The effect of the growth retardant chlorcholinchloride (CCC), under the semiarid and highly variable climatic conditions of Vojvodina (Yugoslavia), on wheat with different fertilization methods is investigated. Field tests on cherozem soils from 1966 to 1968 on a 5 meter square plot consisted of control and 6 topdressing treatments. CCC was applied at tillering and shooting. Yield stem height, internode length, spike length, spikelet density, kernel density, kernel weights, grain weight density, and lodging rate were recorded. Precipitation ranged from 14 to 22 inches per year. CCC had no effect in years of high precipitation, where high nitrogen applications ensured stable and high yields. CCC applied in dry years reduced plant height and ear length. CCC effects depend on weather conditions. Tables show precipitation data, and CCC effects on stem and internode length, ear, lodging, weight, and yield properties. (Popkin-Arizona)
W72-03694

POSSIBLE INCREASE IN COTTON RESISTANCE TO WATER SHORTAGE BY DISPERSION OF COPOLYMER-VINYL-ACETATE,
Institute for Plant Protection, Belgrade (Yugoslavia); and Federal Inst. of Hydrometeorology, Belgrade (Yugoslavia); and Belgrade Univ. (Yugoslavia). School of Agriculture.
S. Cuturilo, B. Ratkovic, and M. Milic.
Savremena Poljoprivreda, Vol 18, No 7-8, p 653-658, 1970. 2 fig, 2 tab, 5 ref.

Descriptors: *Cotton, *Drought resistance, *Water shortage, *Dispersion, *Water conservation, Limiting factors, Corn (Field), Wheat, Sugar beets, Vine crops, Arid lands, Evapotranspiration control, *Plant growth regulators, Experimental farms, Greenhouses, Soil moisture, Optimization, Water utilization, Emulsion, Surfactants, Weight, Leaves, Wilting, Treatment, Soil-water-plant relationships.
Identifiers: *Antitranspirants, *Drought control chemicals, Esters, Vitality, Semiarid lands, Yugoslavia, Copolymer-vinyl acetate.

Drought limits production of corn, wheat, cotton, sugar beets, grapevine, and other crops in Yugoslavia's arid and semiarid regions. Antitranspirants, or drought control chemicals, were applied to cotton under controlled greenhouse conditions to investigate methods of optimizing soil moisture utilization, reducing evapotranspiration losses, and conserving agricultural water. Antitranspirants consisted of esters of copolymer vinyl acetate formulated as an emulsion, with or without surfactant. Visual plant observation, plant weight, leaf counts and wilting signs were noted. Treated plants had extended plant vitality, remained protected from adverse drought effects, and economically used available soil moisture. Tables show state of plants (number of plants, leaves and wilted plants) under untreated and treated conditions, and final plant weight. Figures show reduction rate of the number of vitally active plants, and photograph of selected untreated and treated plants. (Popkin-Arizona)
W72-03697

ROOT-SHOOT RATIOS OF NATIVE FOREST HERBS AND ZEA MAYS AT DIFFERENT SOIL--MOISTURE LEVELS,
G. J. Struik, and J. R. Bray.
Ecology, Vol 51, No 3, p 892-893, Late Summer 1970. 1 tab, 7 ref.

Descriptors: *Primary productivity, *Plant root systems, *Drought resistance, *Corn (Field), On-site investigations, Soil moisture, Forests.

Previous studies have indicated that root/shoot ratios of herbaceous plants increase with habitat dryness. Plants of 7 species of forest herbs were excavated and weighted weekly through 2 growing seasons in a native Wisconsin forest. Below groundweight percentages were calculated for the period of maximum production. All 7 species had higher below ground dry weight ratios for xeric sites than for mesic or noist sites. Using soil cores for sampling below-ground production, the same calculations were made for Zea mays in 1 season in which part of a field was drought-affected. The below ground production percentage was nearly 3 times as great for the drought-affected plants. (Casey-Arizona)
W72-03701

HOPI COLONIZATION ON THE COLORADO RIVER,
San Fernando Valley State Coll., Northridge, Calif.
E. G. Mcintire.
California Geographer, Vol 10, p 7-14, 1969. 1 fig, 2 tab.

Descriptors: *Indian reservations, *Irrigation systems, *Colorado River, *Arid lands, *Social impact, Social values, Economic feasibility, Legal aspects, Agriculture, Water resource development, Arizona.
Identifiers: *Agricultural resettlement schemes.

The Hopi Indians of Northeastern Arizona practice a subsistence agriculture on their generally rocky and barren reservation. Tribal population pressures have been steadily increasing throughout this century. The Bureau of Indian Affairs conceived the plan of lessening these pressures by sponsoring a resettlement scheme. The Colorado Indian Reservation occupies about 415 sq miles mostly along the Arizona side of the river and has ample soil and water resources for extensive irrigated agriculture. In the late 1930's only the northern 1/2 of the reservation was being exploited by Mohave and Chemehuevi Indians, leaving about 75,000 irrigable acres in the southern part undeveloped. Between 1945 and 1951, 116 Navajo families, 32 Hopi families and 3 Supai families were resettled on the reservation. The original problems of the colonists involved both social and physical living conditions. By 1960, housing was much better, commercial and forage crops were being widely produced and 37.9% of the original Navajo families and 62.1% of the original Hopis remained. In evaluating the success of the project, it was seen that original project goals were not attained, but that the settlers were dissidents in their original tribes so that their relocation served to lessen social tensions on the overcrowded reservations. (Casey-Arizona)
W72-03708

SEEDLING SURVIVAL ON EROSION CONTROL TREATMENTS IN A SALT DESERT AREA,
Utah State Univ., Logan. Dept. of Range Science.
For primary bibliographic entry see Field 04D.
W72-03712

EFFECT OF SITE CLASS AND RAINFALL ON ANNUAL RANGE RESPONSE TO NITROGEN AND PHOSPHORUS,
Agricultural Research Service, Riverside, Calif.
For primary bibliographic entry see Field 04A.
W72-03713

ACTIVATED SLUDGE SOIL CONDITIONER UPS CROP RETURNS AT KIMBERLY-CLARK,
For primary bibliographic entry see Field 05D.
W72-03735

USE OF SOIL TO TREAT ANAEROBIC LAGOON EFFLUENT RENOVATION AS A FUNCTION OF DEPTH AND APPLICATION RATE,
Iowa State Univ., Ames. Dept of Agricultural Engineering.
For primary bibliographic entry see Field 05D.
W72-03740

AN ECONOMIC LAND CLASSIFICATION OF THE IRRIGATED CROPLAND IN THE PECOS RIVER BASIN, NEW MEXICO,
New Mexico State Univ., University Park. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 06B.
W72-03769

EFFECT OF STAGE OF GROWTH OF COWPEAS ON EVAPO-TRANSPIRATION RATES BY THE CROP,
College of Agriculture, New Delhi (India).
B. G. Bathkal, and N. G. Dastane.
J Shivaji Univ. 2/3 (3/45/6): 59-62. 1969/70.
Identifiers: Available, Cowpeas-D, Crop, Evapo, Flowering, Growth, Irrigation, Moisture, Rates, Schedule, Soil, Transpiration.

The actual water use rates by the crop depended on the available soil moisture and stage of crop growth. In summer grown cowpeas, the actual as well as the relative evapo-transpiration rates were much higher during the pre-1st-flowering stage than during the subsequent growth stages. Hence, the energy approach alone is not adequate in working out the irrigation schedules.--Copyright 1971, Biological Abstracts, Inc.
W72-03804

ROOT AND FOLIAGE GROWTH OF OATS AT SEVERAL LEVELS OF FERTILITY AND MOISTURE,
Iowa Agricultural and Home Economics Experiment Station, Ames.
M. J. McNeill, and K. J. Frey.
Agron J. 61 (3): 461-4464. Illus. 1969.
Identifiers: Culture, Fertility, Foliage, Growth, Moisture, Nitrogen, Oats-M, Phosphorus, Pot, Potassium, Root.

The effects of fertility and moisture on root and shoot growth of oats (Avena sativa L.) were studied in pot-culture experiments. An experimental unit was a 75-liter garbage can filled with low-fertility Thurman sand, embedded 0.6 m deep in the soil. Forty-eight cans were covered with a plastic shelter to permit controlled moisture regimes. A factorial set of fertilizer treatments using 2 levels each of N (0 and 140 kg/ha), P (0 and 93 kg/ha), and K (0 and 93 kg/ha) were applied at seeding time. At the initiation of stem elongation, wet (field capacity) and dry (wilting coefficient) moisture regimes were imposed across all fertility treatments. Traits measured on the plant tops were plant height, number of tillers, number of spikelets per panicle, dry weight and stem diameter. Weights were taken on roots extracted from 0.007-m cu soil samples from the 0-15-, 15-30-, 30-45-, and 45-60-cm soil depths. The root and shoot growth responded more to fertilizer application when moisture was adequate than when deficient. Nitrogen and P, applied alone and in combination, gave more shoot and root growth than any other element or combination of elements. Shoot growth responded to added fertilizer in both the high and low moisture regimes, but root growth responded only in the wet regime. Leaching of the nutrients with surface irrigations caused maximum root response to N in the 30-45-cm zone, but for P, which resists leaching, maximum response was in the 0-15-cm zone. Reduced root-top ratios resulting from added moisture and fertilizer elements were due largely to large increases in top growth without concomitant increases in root growth. Increase in shoot weight from added fertilizer under the dry regime was not accompanied by increased root weight. We concluded that root response to added fertility could not be responsible for oat plants utilizing subsoil (30-60-cm depth) moisture to produce increased shoot weights.--Copyright 1971, Biological Abstracts, Inc.
W72-03805

DEFOLIATION OF BEAN SEEDLINGS BY INJURY FROM RAIN,
New York State Agricultural Experiment Station, Geneva.
J. J. Natti, and F. D. Judge.
Plant Dis Report. 55 (5): 457-459. Illus. 1971.
Identifiers: Bean-D, Compression, Defoliation, Injury, Mechanical, Phaseolus-Vulgaris-D, Pulvini, Rain, Resistance, Seedlings, Upper.

Defoliation of bean (Phaseolus vulgaris) seedlings in a commercial planting was found to be caused by injury to tissues of upper pulvini of petioles of primary leaves. The injury resulted from pressure of heavy rain and repeated impingement of large raindrops on the surface of turgid primary leaves. This pressure produced sufficient stress to overcome the mechanical resistance of the pulvinar tissues and to cause compression and injury to tissues at the underside of the pulvini. Defoliated plants were delayed in development but otherwise subsequent growth appeared normal. Defoliation resulted in an estimated 30% reduction in yield of dry beans.--Copyright 1971, Biological Abstracts, Inc.
W72-03808

RESISTANCES TO WATER TRANSPORT IN SOYBEAN, BEAN, AND SUNFLOWER,
Illinois Univ., Urbana. Dept. of Botany; and Illinois Univ., Urbana. Dept. of Crop Physiology.
J. S. Boyer.
Crop Sci. 11 (3): 403-407. 1971.
Identifiers: Bean-D, Flow, Glycine-Max-D, Helianthus-Annuus-D, Method, Phaseolus-Vulgaris-D, Resistances, Soy, Sunflower-D, Transient, Transpiration, Transport.

The resistance to water transport in whole plants and plant segments was measured by a transient flow method for soybean (Glycine max L. (Merr.) var. 'Harosoy'), bean (Phaseolus vulgaris L. var. 'Bountiful'), and sunflower (Helianthus annuus L. var. 'Russian Mammoth'). The resistance to water transport in whole soybean plants was twice that of sunflower and bean. The high resistance in soybean was caused by a high resistance in the root tissue external to the root vascular tissue. The data indicate that leaf water potential will have to drop about twice as far in soybean as in sunflower or bean to maintain a given rate of water transport to the leaf evaporating surface.--Copyright 1971, Biological Abstracts, Inc.
W72-03811

ECONOMIC IRRIGATION SCHEDULING AND THE DEMAND FOR IRRIGATION WATER,
A. W. Biere.
Paper, Western Agricultural Economics Associating Meeting, Squaw Valley, California, July 1971. 7 p, 1 fig, 7 ref.

Descriptors: *Irrigation, *Scheduling, *Irrigation water, Irrigation efficiency, Water demand, Economics, Plant growth, Soil moisture, Soil-water-plant relationships, Evapotranspiration, Mathematical models, Dynamic programming, Water management.

A dynamic irrigation scheduling model is developed to maximize net returns from irrigated crop production. The model is dynamic because it explicitly considers irrigation timing, and recognizes that irrigation cycles are interdependent in both soil level moisture and cumulative plant growth. Potential benefits are: the model could provide better management information for irrigators, and improved estimates of irrigation water demand for public water agencies. The components of a crop growth model are available soil moisture budget, evapotranspiration function, and crop growth function. These components, and equations for computing their numerical values are given. The crop growth model provides the necessary physical and biological information needed for an irrigation scheduling model. The last component is the economic, or criterion, function--a maximization of net returns to irrigation. The model could also provide irrigation water demand information for public water agencies, and may be useful in evaluating alternative irrigation systems. (USBR)
W72-03912

PLANNING AND DEVELOPING THE MULTI-PURPOSE GARRISON DIVERSION UNIT,
Garrison Diversion Conservancy District, N. Dak.
For primary bibliographic entry see Field 04A.
W72-03913

DECISION MODELS FOR MINIMIZING THE COST INFORMATION ON ERROR IN ESTIMATING BENEFIT-WATER RELATIONSHIPS WITH SPECIAL APPLICATIONS TO IRRIGATION,
New Mexico State Univ., University Park. Water Resources Research Inst.
For primary bibliographic entry see Field 06B.
W72-03988

ECONOMICS OF WATER USE AND WASTE DISPOSAL IN DELAWARE VEGETABLE PROCESSING,
Delaware Univ., Newark. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 05D.
W72-03996

WAX DIP FOR TOMATO TRANSPLANTS,
Delaware Univ., Newark. Dept. of Plant Science.
D. J. Fieldhouse, and E. L. Ratledge.
Transactions of the Peninsula Horticulture Society, Vol 58, p 16-18. 1 tab, 2 ref. OWRR A-010-DEL (2).

Descriptors: *Moisture stress, *Transpiration, Plant physiology, Plant growth, *Crop response, Growth stages, Transpiration control.
Identifiers: *Tomatos, *Transplant, *Transpiration suppressant, *Wax.

A transplant dip, using Sunoco folicote (a wax-base transpiration suppressant), prior to the shipment of tomato plants from Georgia to Delaware reduced dessication during shipment and resulted in an increase in yield. The wax-dipped plants began growth earlier following transplanting than the controls as a result of reduced moisture stress and an increase in plant temperature which accompanied the reduction in transpiration. Plants completely dipped in the transpiration suppressant had higher yields than the controls, but they did not produce as much as the plants which were only top-dipped.
W72-03997

USE OF GROWTH RETARDANTS FOR INCREASING TOMATO YIELDS AND ADAPTATION FOR MECHANICAL HARVEST,
Delaware Univ., Newark. Dept. of Plant Science.
P. E. Read, and D. J. Fieldhouse.
Journal of American Society of Horticultural Science, Vol 95, No 1, p 73-78, January 1970. 5 fig, 6 tab, 11 ref. OWRR A-010-DEL (3).

Descriptors: *Crop response, Drought resistance, *Foliar application, Growth rates, Growth stages, Heat resistance, *Moisture stress, Period of growth, Plant growth, *Plant growth regulators, Plant physiology, Flowering, Harvesting.
Identifiers: *Tomato yield, *Fruit set, Fruit quality.

Tomato yields were increased by foliar sprays of succinic acid 2,2-dimethyl hydrazide (Alar) and 2-chloroethyl trimethylammonium chloride (Cycocel). The most effective treatments were 2500 ppm Alar at the first true leaf stage, and 2500 ppm Alar at the fourth true leaf stage. Concentration of harvest was improved and early harvest was increased by subsequent application of 5000 ppm Alar as a flower 'cut-off' spray after desired fruit set had been achieved. This treatment offers good possibilities for mechanical harvesting as it eliminated green fruit 'pick-out' and slowed vegetative growth, thus allowing a more concentrated harvest of earlier maturing fruit. The yield increases are attributed to a combination of effects including resistance to water and heat stresses, more flowers per cluster and thus more fruits per plant. That fruit quality was increased was evidenced by increased fruit color and firmness, by less cracking and a lower incidence of blossom-end rot.
W72-03998

AN EXPERIMENTAL STUDY OF EDDY DIFFUSION COEFFICIENTS, EVAPOTRANSPIRATION AND WATER USE EFFICIENCY,
Illinois Univ., Urbana. Water Resources Center.
For primary bibliographic entry see Field 02D.
W72-04083

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

CHARLES RIVER LOCKS AND DAM, BOSTON, MASSACHUSETTS.
Corps of Engineers, Waltham, Mass. New England Div.

Available from the National Technical Information Service as PB-202 722-F, $3.00 in paper copy, $0.95 in microfiche. 17 Sep 71, 37 p.

Descriptors: *Environmental effects, *Flood control, *Massachusetts, *Multiple purpose reservoirs, Dams, Pumping stations, Locks (Waterways), Fishes, Fish ladders.
Identifiers: *Environmental impact statements, Boston (Massachusetts.

The project is concerned with improvement of a multiple purpose reservoir in Boston, Massachusetts, for the primary purpose of flood control. Adverse impact effects are not anticipated.
W72-03504

ELK CREEK LAKE, ROGUE RIVER BASIN, OREGON.
Army Engineer District, Portland, Oreg. Elk Creek Lake, Rogue River Basin, Oregon.

Available from the National Technical Information Service as PB-202 670-F, $3.00 in paper copy, $0.95 in microfiche. Draft enviromental statement, 17 Sep 71, 41p.

Descriptors: *Environmental effects, *Earth dams, *Reservoirs, *Oregon, Flood control, Water conservation, Forest land, Wildlife, Fishes, Relocation.
Identifiers: Archaeology, *Environmental impact statements, *Elk Creek Lakes, *Jackson County (Oregon), Rogue River Basin.

The statement concerns the construction of an embankment dam and related structures on Elk Creek, Jackson County, Oregon to provide 95,000 acre feet of usable storage for flood control and water conservation for municipal and industrial water supply. The impacts will include: Flooding of river valley behind dam used for timber production, farming, pasture and wildlife habitat; Loss of a 6 mile stretch of natural stream to be covered by the lake; Road relocation; Loss of natural stream with anadromous fish spawning and rearing areas within the proposed lake area.
W72-03505

LOWER BRANCH RUSH RIVER, NORTH DAKOTA.
Army Engineer District, St. Paul, Minn.

Available from the National Technical Information Service as PB-202 455-F, $3.00 in paper copy, $0.95 in microfiche. Draft environmental statement, 11Aug 71, 22p.

Descriptors: *Environmental effects, *Flood control, *North Dakota, River regulation, Channel improvements, Rivers, Dredging.
Identifiers: *Environmental impact statements, *Cass County (North Dakota), *Rush River.

The authorized project features channel enlargement and straightening of 17.3 miles of the Lower Branch Rush River and similar work on 7.5 miles of its southern tributary for flood control. The project is located in Cass County, North Dakota. With a lessened flood threat, earlier planting dates, more consistent crop harvest, less weed infestation, and fewer fences and other facilities to repair during flood years would lead toward stabilizing farm income and enhancing the well-being of farmers in the area. The channel improvement on the Lower Branch Rush River would affect neither flood heights on the Sheyenne River at the mouth of the Lower Branch Rush River nor the groundwater in the vicinity of the channel reaches to be improved. Removal of tall native grasses and about 12 acres of trees and shrubs along the existing streams will be unavoidable.
W72-03506

NEABSCO CREEK, PRINCE WILLIAM COUNTY, VIRGINIA.
Army Engineer District, Baltimore, Md.

Available from the National Technical Information Service as PB-202 913-D, $3.00 in paper copy, $0.95 in microfiche. Draft environmental statement, 17 Sep 71, 12p.

Descriptors: Environmental effects, *Channel improvements, *Virginia, *Dredging, Navigation, Land use, Turbidity.
Identifiers: *Environmental impact statements, Neabsco Creek (Virginia), *Prince William County (Virginia).

The project involves dredging to improve small boat navigation, with a channel and a turning basin. Adverse environmental effects include the loss of 5-6 acres of bottom biota, temporary turbidity during construction, and possible loss of wetlands if used as disposal areas.
W72-03507

HILLSDALE LAKE, BIG BULL CREEK, KANSAS.
Army Engineer District, Kansas City, Mo.

Available from the National Technical Information Service as PB-202 917-D, $3.00 in paper copy, $0.95 in microfiche. Draft environmental statement, 17 Sep 71, 26p.

Descriptors: *Environmental effects, *Reservoirs, *Kansas, *Flood control, Water supply, Erosion, Turbidity.
Identifiers: *Environmental impact statements, *Hillsdale Lake, *Miami County (Kansas).

Hillsdale Lake would be located on Big Bull Creek in Miami County about 2-1/2 miles west of Hillsdale and 5 miles northwest of Paola, Kansas. The impacts include: Stream control and flow alteration; temporary soil erosion, turbidity, noise during construction; downstream flood control; provision of a 4,580-acre lake; altered traffic patterns; control of siltation; development of mud flats; municipal and industrial water supply and water quality releases; contributing to water supply shortage at a State waterfowl area; relocation of 92 family units.
W72-03508

LITTLE BLUE RIVER CHANNEL, LITTLE BLUE RIVER, MISSOURI.
Army Engineer District, Kansas City, Mo.

Available from the National Technical Information Service as PB-202 916-D, $3.00 in paper copy, $0.95 in microfiche. Draft environmental statement, 17 Sep 71, 13p.

Descriptors: *Environmental effects, *Flood control, *Missouri, *Channel improvements, Levees, Wildlife.
Identifiers: *Environmental impact statements, Little Blue River, *Jackson County (Missouri).

Construction is proposed of a flood control protection project consisting of channel improvement and a system of levees in Jackson County, Missouri, near the Kansas City metropolitan area. The channelization will change the natural character of the river channel, associated stream biota and adjacent wildlife habitat.
W72-03509

KEHOE LAKE, TYGARTS CREEK, KENTUCKY.
Army Engineer District, Huntington, W. Va.

Available from the National Technical Information Service as PB-202 915-D, $3.00 in paper copy, $0.95 in microfiche. Draft environmental statement, 16 Sep 71, 16p.

Descriptors: *Environmental effects, *Reservoirs, *Kentucky, *Dams, *Flood control, Recreational facilities, Erosion, Turbidity, Sedimentation, Water supply.
Identifiers: *Environmental impact statements, *Kehoe Lake, *Carter County (Kentucky).

The project concerns the construction and operation of a dam and other facilities for flood control, recreation, fish and wildlife enhancement, and water quality control purposes, in Carter County, Kentucky. The adverse environmental effects include the loss of cropland and forest land and some types of biotic habitat, disruption of the environments of persons now residing on the lands to be acquired, temporarily increased erosion and sedimentation due to construction.
W72-03510

CONTENTNEA CREEK, LENOIR AND PITT COUNTIES, NORTH CAROLINA, FLOOD CONTROL.
Army Engineer District, Wilmington, N.C.

Available from the National Technical Information Service as PB-202 914-D, $3.00 in paper copy, $0.95 in microfiche. Draft environmental statement, 16 Sep 71, 12p.

Descriptors: *Environmental effects, *Flood control, *North Carolina, Wildlife, Ecology.
Identifiers: *Snagging, *Clearing, *Environmental impact statements, *Lenoir County (North Carolina), *Pitt County (North Carolina).

Clearing and snagging of Contentnea Creek is proposed in Lenoir and Pitt Counties, North Carolina. Removal of logs and trees from the creek will represent a reduction in food and shelter for fish and other aquatic organisms.
W72-03511

A STOCHASTIC MULTI-LEVEL OPTIMIZATION TECHNIQUE FOR DESIGN OF A MULTI-PURPOSE WATER RESOURCE PROJECT,
California Univ., Los Angeles. School of Engineering and Applied Science.
For primary bibliographic entry see Field 06A.
W72-03539

THE DYNAMICS OF A COAST WITH A GROYNE SYSTEM,
Rijkswaterstaat-Deltadienst, The Hague (Netherlands). Coastal Research Dept.
For primary bibliographic entry see Field 02J.
W72-03592

STUDY OF DURBAN HARBOR SILTING AND BEACH EROSION,
National Mechanical Engineering Research Inst., Durban (South Africa).
For primary bibliographic entry see Field 02J.
W72-03595

FOOD, FIBER AND THE ARID LANDS.
Arizona Univ., Tucson. Office of Arid-Lands Research.
For primary bibliographic entry see Field 03F.
W72-03652

THE GOBI DESERT OF MONGOLIA: GEOGRAPHIC DESCRIPTION AND PROSPECTS

FOR LAND USE ON THE BASIS OF SOIL, VEGETATION, HYDROLOGY, AND CLIMATE,
Polish Academy of Sciences, Warsaw. Inst. of Geological Science.
For primary bibliographic entry see Field 03F.
W72-03660

RUNOFF AGRICULTURE IN THE NEGEV DESERT OF ISRAEL,
Hebrew Univ., Tel-Aviv (Israel). Dept. of Botany.
For primary bibliographic entry see Field 03F.
W72-03668

ARTIFICIAL INDUCEMENT OF RUNOFF AS A POTENTIAL SOURCE OF WATER IN ARID LANDS,
Hebrew Univ., Jerusalem (Israel).
For primary bibliographic entry see Field 03F.
W72-03669

SAND-STABILIZATION METHODS IN ARID LANDS: PROTECTION OF AGRICULTURAL AND SETTLEMENT AREAS,
Leningrad State Univ. (USSR). Dept. of Geography.
For primary bibliographic entry see Field 03F.
W72-03671

STABILIZATION OF SAND DUNES IN THE SEMIARID ARGENTINE PAMPAS,
Instituto Nacional de Tecnologia Agropecuaria, Castelar (Argentina). Centro Nacional de Investigaciones Agropecuarias; and Wisconsin Univ., Milwaukee.
For primary bibliographic entry see Field 03F.
W72-03672

A CHANCE-CONSTRAINED APPROACH TO THE CONJUNCTIVE USE OF SURFACE WATERS AND GROUNDWATERS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Environmental Resources.
G. H. Nieswand, and M. L. Granstrom.
Water Resources Research, Vol 7, No 6, p 1425-1436, December 1971. 7 fig, 5 tab, 13 ref.

Descriptors: *Linear programming, *Stochastic processes, *Surface waters, *Ground water, Planning, Decision making, Constraints, Streamflow. New Jersey, Mathematical models.
Identifiers: *Mullica River basin (NJ).

The development of a conjunctive use planning model incorporating the stochastic nature of the problem and including indirect considerations of the various uses of streamflow was considered. Models were developed for the Mullica River Basin in New Jersey. A cyclical planning horizon having an overall duration of 1 year and composed of 12 one-month periods was selected for developing the conjunctive use models. A cyclical horizon was chosen because of the desirability of developing a continuous supply of water for an indefinite period of time. The chance-constrained modes for the Mullica River basin could not be solved as formulated. First it was necessary to define deterministic equivalents for these models. This definition required the transformation of the chance constraints on residual streamflow to a deterministic form. An example of the complete operational results obtained from the set of conjunctive use models developed for the Mullica River basin and presented on a monthly basis for the cyclical planning horizon is described. Chance constraining was shown to be a useful technique for models involving stochastic quantities. The method was particularly desirable if the deterministic equivalents for the chance constrainted models led to formulations for which standard solution procedures were available. (Ligon-Cornell)
W72-03681

OPTIMIZATION MODELS FOR THE ANALYSIS OF WATER RESOURCES SYSTEMS,
California Univ., Los Angeles. Dept. of Engineering.
For primary bibliographic entry see Field 06A.
W72-03688

EFFECT OF SITE CLASS AND RAINFALL ON ANNUAL RANGE RESPONSE TO NITROGEN AND PHOSPHORUS,
Agricultural Research Service, Riverside, Calif.
R. E. Luebs, A. E. Laag, and M. J. Brown.
Journal of Range Management, Vol 24, No 5, p 366-370, September 1971. 7 tab, 14 ref.

Descriptors: *Sites, *Ranges, *Range management, *Rainfall, *Crop response, Soil-water-plant relationships, Plant growth regulators, Nitrogen, Phosphorus, Fertilizers, Treatment, California, Grasslands, Soil chemical properties, Nutrients, Deficient elements, Limiting factors, Arid lands, Experimental farms, Surveys, Vegetation effects, Forecasting, Water distribution (applied), Forages, Crop production, Slopes, Rates of applications, Variability.
Identifiers: Dry matter, Swales, Semiarid lands.

Annual amount of rainfall is the principal factor determining dry matter production in California grasslands, where soils are inherently low in nitrogen and less deficient in phosphorus. About 1.5 million acres of annual range are in the lower rainfall area of Southern California. Cattle-free experimental sites were soil and vegetation surveyed, classed and fertilizer treated. Range site effects on the response to fertilizer and residual effect of applied fertilizer under low and less predictable water availability conditions were investigated. Forage yield increases from fertilizer application were in the following order according to site class: swale more than gentle slope more than open slope. Forage increased greatest for low N applications at slope sites and for high applications of swales. Site class and fertilizer residual effects are significant in fertilizer application programs in low rainfall areas with high annual rainfall variability. Nitrogen deficiency must be corrected before phosphorus response is significant on forage yield. Tables show experimental site characteristics, forage yield responses to fertilizer application, and nitrogen content of forage. (Popkin-Arizona)
W72-03713

PHENOLOGY AND CONTROL OF COMMON BROOMWEED ON TEXAS RANGELANDS,
Texas A and M Univ., College Station. Dept. of Range Science.
C. J. Scifres, R. R. Hahn, and J. H. Brock.
Journal of Range Management, Vol 24, No 5, p 370-373, 1971. 1 fig, 4 tab, 5 ref.

Descriptors: *Weed control, *Herbicides, *Phenology, *Plant growth regulators, *Ranges, Range grasses, Soil types, Grasslands, Annual, Seasonal, Grazing, Drought, Texas, 2-4-D, Treatment, Germination, Vegetation establishment.
Identifiers: *Broomweed, Stem elongation, Picloram, Dicamba, Application time, Semiarid lands.

Common broomweed, an annual composite, can become a serious problem where overgrazing or drought reduces range grasscover, as it invades ranges without preference to soil type. The weed occurs in grasslands from northern Kansas to the Gulf Coast and from western New Mexico to central Iowa. Herbicide control of broomweed in semiarid rangelands has varying degrees of success. The possible interaction of phenological development with susceptibility of common broomweed to several herbicides is investigated in Texas. Broomweed was effectively controlled with 2,4-D at 0.125, 0.25 or 0.5 lb/acre applied during stem elongation around May 15. Effectiveness of 2,4-D, Picloram combinations, and dicamba are discussed under various times of application and concentrations. No treatment prevented germination and weed establishment in the fall following herbicide application in the spring. Tables and figures show general height growth curve and phenological activity, and broomweed reduction after treatment. (Popkin-Arizona)
W72-03714

SOME SOIL AGE-RANGE VEGETATION RELATIONSHIPS,
South Dakota State Univ., Brookings. Dept. of Plant Science.
E. M. White.
Journal of Range Management, Vol 24, No 5, p 360-365, September, 1971. 3 fig, 21 ref.

Descriptors: *Environmental effects, *Vegetation, *Soil formation, *Ranges, *Plant groupings, Slopes, Soil types, Soil texture, Drainage, Surveys, Maps, Soil profiles, South Dakota, Soil dynamics, Grama grasses, Wheatgrasses, Soil structure, Fertility, Soil moisture, Moisture availability, Nutrients, Soil-water-plant relationships.
Identifiers: *Soil age, Tall grasses.

Environmental factors affecting vegetation include slope gradient, slope aspect, soil type, soil age, soil texture and drainage. Specie vegetation surveys, soil maps, soil profiles and numerous observations were made over 10 years in west central South Dakota to show how soil texture and development determine the kinds of range plants present. Bluestems, sideoats grama, and prairie sandreed are important on very weakly developed soils. Western wheatgrass, green needlegrass, and buffalograss are important on well developed soils except on very coarse textures where needle and thread is important. Cool-season mid- and tallgrasses are important on strongly developed soils. Soil structure and fertility are the major factors affecting vegetation as soil develops, as these properties are related to soil-moisture and nutrient availability. (Popkin-Arizona)
W72-03715

THE FOREST ENVIRONMENT--PROBLEMS AND PROMISES,
Oregon State Univ., Corvallis. Dept. of Forest Engineering.
G. H. Jemison.
In: Technology and Management of the Environment, Seminar, Oregon State University, Water Resources Research Institute, p 23-29, July 1971.

Descriptors: *Forest, *Forestry management, *Planning, *Multiple purpose, *Watershed management, Social aspects, Economic impact, Trees, Wood wastes, Political aspects, Technology, Recreation, Aesthetics, Conservation, Ecosystems, Environmental effects.

Society is generating a series of conflicting demands on our forest resources: recreation, aesthetics, hunting, solitude, wood products and high quality water. Although we are growing more wood than we are currently using, projections indicate that our timber supply capabilities will soon be overtaxed unless current timber management and utilization practices are substantially improved. Much the same problem holds for water also, because our forests and associated high-elevation areas produce about 3/4 of our total water supplies. It is felt that the best approach to forest management should have the objective of maximizing the mix of goods and services through coordinated multiple-use management. Technology offers the hope of many improvements. More efficient utilization of wood and its waste products at the mill, better silvicultural practices, biological control of forest pests, breeding for more productive trees, more efficient logging practices and better forest landscape management practices all hold great promise. We must begin looking at the whole system, and understand the inter-relationships of biological, physical, and social processes. (See also W72-03716) (Casey-Arizona)
W72-03720

THE OPTIMIZATION OF WATER RESOURCES DEVELOPMENT, II,
California Univ., Los Angeles. School of Engineering and Applied Science.
For primary bibliographic entry see Field 06A.
W72-03763

MANAGEMENT ALTERNATIVES IN THE USE OF THE WATER RESOURCES OF THE PECOS RIVER BASIN IN NEW MEXICO,
New Mexico State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06A.
W72-03771

RANGELAND MANAGEMENT IN AUSTRALIA,
Utah State Univ., Logan.
Thadis W. Box, and Rayden A. Perry.
Range Manage. 24 (3): 167-171. Map. 1971.
Identifiers: Australia, Cattle, Management, Rangeland, Sheep.

The term 'rangeland' in Australia is used to designate the arid and semi-arid areas unsuitable for crop production. The lands of this pastoral zone cover about 2,200,000 sq m. This vast area accounts for 74% of the continent, yet it is occupied by only 3% of its people. Of the total area, over 99% is unimproved native rangeland, less than one-half of 1% is improved pasture, and less than 1/10 of 1% is cropped. Almost a 1/3 of the land is unoccupied. The arid rangelands carry about 1/3 of the country's sheep and beef cattle. These livestock produce about $400,000,000 in export income for the country. Ranges are managed on a low capital and labor input system. Many of the larger cattle properties are unfenced; livestock are controlled by water development. Areas around water and smaller properties in the arid zone may be severely deteriorated in range condition. Current research projects are designed to provide information to prevent further decline in productivity, aid development, and to improve management.--Copyright 1971, Biological Abstracts, Inc.
W72-03798

LAND USE AND WILDLIFE RESOURCES,
Sanford S. Atwood.
National Academy of Sciences: Washington, D.C., 1970, Price $6.95. 262 p.
Identifiers: America, Birds, Book, Fish, Land, Mammals, North, Pesticides, Resources, Wildlife.

This review gives a generalized interpretation of trends in land use and wildlife resources. Emphasis is on mammals, birds and fish as they are valued for sport, commercial or esthetic reasons. The introductory chapter gives a historical perspective discussing primitive conditions in North America, exploration and settlement, land use and planning and biological interpretations. Subsequent chapters discuss: wildlife values and tradition; modernization of agriculture and changes in water and wetlands; influence on land management on wildlife; water and watersheds; pesticide influence on wildlife; and wildlife damage and control. The last chapter discusses legislation and administration as a tool of resource management. Bibliographies conclude each chapter.--Copyright 1971, Biological Abstracts, Inc.
W72-03799

CHEMICAL CONTROL OF THE AQUATIC PLANT AGUAPE (WATER HYACINTH) IN THE RIO PRETO, MUNICIPALITY OF PERUIBE, SAO PAULO,
Instituto Biologico de Sao Paul (Brazil).
L. Leiderman, and N. Grassi.
Biologico (Sao Paulo). 36 (6): 157-159. 1970.
Identifiers: Aguape-M, Aquatic, Brazil, Chemical, Control, Diquat, Eichornia-Crassipes-M, Herbicides, Municipality, Paraquat, Peruibe, Plant, Reglone, Rio-Preto, Sao-Paulo, Tordon, Water-Hyacinth-M, Weed.

Four different herbicides were applied to the leaves of the aguape (Eichhornia crassipes (Mart.)) Solms: Gramoxone (Paraquat), Reglone (Diquat), Formula 40 (2,4-D amine) and Tordon 101 (picolinic acid plus 2,4-D). Best results were achieved with Reglone at the rate of 2.5 l/ha, and Formula-40 at 10 l/ha.--Copyright 1971, Biological Abstracts, Inc.
W72-03807

CUBIC INTERPOLATION FOR NUMERICAL FLOOD ROUTING,
Turner, Collie and Braden Co., Inc., Houston, Tex.
For primary bibliographic entry see Field 02E.
W72-03843

ROUTING STORM WATER THROUGH A DRAINAGE SYSTEM,
Asian Inst. of Tech., Bangkok (Thailand). Dept. of Hydraulics Engineering.
S. Pinkayan.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 98, No HYl, Paper 8642, p 123-135, January 1972. 7 fig, 6 ref, append.

Descriptors: *Routing, *Storm drains, *Computer programs, Numerical analysis, Hydrographs, Hydrograph analysis, Unsteady flow, Flood routing, Storm runoff, Urbanization.
Identifiers: Storm water routing, *Urban hydrology.

Unsteady flow equations for routing storm water through storm drainage systems with lateral inflow can be solved by the method of characteristics on digital computers. The storm drain consists of a single continuous line of circular channel with constant slope. The main inflow to the drain is at the upstream end. The lateral inflow comes through a circular conduit at the junction box, normal to the direction of the main drain. The outflow is a free fall downstream. Good agreement is found in comparing computed hydrographs and observed hydrographs at various locations along the drain. (Knapp-USGS)
W72-03847

TWO-DISTRIBUTION METHOD FOR FLOOD FREQUENCY ANALYSIS,
Illinois State Water Survey, Urbana.
K. P. Singh, and R. A. Sinclair.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 98, No HY 1, p 29-44, January 1972. 6 fig, 3 tab, 16 ref. append.

Descriptors: *Flood forecasting, *Frequency analysis, *Statistics, *Computer programs, Hydrographs, Illinois, Distribution patterns.
Identifiers: *Flood frequency.

A new method for flood-frequency analysis uses the concept of mixed distributions. A mixture of only two component distributions fits the various observed flood distributions. The two-distribution method was tested using annual flood series from 33 streams in Illinois. The flood distributions computed by this method fit the observed flood distributions better than other methods in use, and match the medium and high floods which are of great interest to the engineers and hydrologists. A methodology was formulated for computer application, and it is free from errors and uncertainties that exist when third and higher order moments are used for obtaining estimates of the component distribution parameters. (Knapp-USGS)
W72-03848

INFLUENCE OF A DROP IN SEA LEVEL AND OF CHANNEL STRAIGHTENING ON THE HYDROLOGIC REGIME IN LOWER REACHES OF THE SULAK RIVER (VLIYANIYE PADENIYA UROVNYA MORYA I SPRYAMLENIYA RUSLA NA GIDROLOGICHESKIY REZHIM NIZOV'YA REKI),
State Oceanographic Inst., Moscow (USSR).
G. N. Gan.
In: Gidrologiya i gidrokhimiya morey i ust'yev rek; Gosudarstvennyy Okeanograficheskiy Institut Trudy, No 98, p 41-48, 1970. 3 fig, 3 tab, 3 ref.

Descriptors: *Water levels, *Discharge (Water), *Stage-discharge relations, *Channel morphology, *Hydraulics, Cross-sections, Width, Depth, Velocity, Stabilization.
Identifiers: *USSR, Dagestan ASSR, Sulak River, Caspian Sea, Flow velocity.

The water-level regime in the lower reaches of the Sulak, the largest river in Dagestan, has a unidirectional tendency to decrease. A drop of 2.4 m in the average annual water level at the Glavnyy Sulak Gaging Station between 1933 and 1967 was due to a 1.9 m drop in the level of the Caspian Sea between 1929 and 1940 and to a straightening of the river channel within the Sulak Delta in 1957. Lowering the sea level and straightening the channel degraded the channel by 3.1 m, reduced the water level in the river 2.4 m and changed the discharge relation Q=f (H), which, in turn, altered the morphometric and hydraulic characteristics of the channel (cross-sectional area, depth, width, and flow velocity). Although these changes were only observed in the first 3-4 years following the drop in sea level, they reoccurred in 1957 after the straightening of the channel. This resulted in a shortening of the river in its lower course to one-third its original length. (Josefson-USGS)
W72-03898

PLANNING AND DEVELOPING THE MULTI-PURPOSE GARRISON DIVERSION UNIT,
Garrison Diversion Conservancy District, N. Dak.
V. S. Cooper.
Paper, 22nd Annual American Institute of Biological Sciences Meeting, Colorado State University, Ft. Collins, August 1971. 10 p.

Descriptors: *Planning, *Irrigation, Irrigation effects, *Project purposes, Project planning, Public benefits, Water resources development, Agriculture, Water supply, Estimated costs, Fish, Wildlife, Water utilization, Wildlife habitats, Irrigation systems.
Identifiers: *Garrison Diversion Unit, MRBP.

The plan for the Garrison Diversion Unit provides for diversion of 871,000 acre-ft of Missouri River water from Lake Sakakawea into central and eastern North Dakota. Water pumped from Lake Sakakawea to Lake Audubon will then be conveyed along a 73-mi-long canal to the 20,000-acre Lonetree Reservoir. A system of rivers and gravity canals radiating from Lonetree Reservoir will: irrigate 250,000 acres; serve 14 municipalities; and provide water for 36 major and 50 small fish and wildlife areas. The 25-county Garrison Diversion Conservancy District is the parent organization of the project and also serves as coordinator. The Conservancy Board represents the interests of agriculture, business, wildlife, and recreation in project planning and development. Board accomplishments include: organizing and conducting an extensive educational program relating to irrigation; aiding the establishment of an agricultural experiment station through its efforts in securing approval and appropriations from the North Dakota State Legislature; and cooperating in a soil management research effort with the North Dakota State University. (USBR)
W72-03913

AUTOMATED SYSTEM CONTROL,
Monroe County Water Authority, Rochester, N.Y.
For primary bibliographic entry see Field 07B.
W72-03915

COMPUTER APPLICATIONS IN DISTRIBUTION,
International Business Machines Corp., Thousand Oaks, Calif.
For primary bibliographic entry see Field 06B.
W72-03920

DECISION-MAKING IN COMMON PROPERTY RESOURCES,
Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Field 06B.
W72-03934

ECOLOGICAL EVALUATION OF LAND FOR PLANNING PURPOSES,
Nature Conservancy, London (England).
For primary bibliographic entry see Field 06B.
W72-03936

COOPERATIVE STUDIES FOR PREPARATION OF THE CHICAGO METROPOLITAN AREA RIVER BASIN PLAN.
Economic Research Service, Chicago, Ill.; Forest Service (USDA), Chicago, Ill.; Soil Conservation Service, Chicago, Ill.; and Metropolitan Sanitary District of Greater Chicago, Ill.
For primary bibliographic entry see Field 06B.
W72-03966

AN ANALYSIS OF THE LAW GOVERNING SIX SELECTED WASHINGTON WATER--ORIENTED SPECIAL DISTRICTS, COMMENTARY ON IMPROVING THE FLOOD-ASSOCIATED ACTIVITIES OF THE STATE OF WASHINGTON DEPARTMENT OF WATER RESOURCES,
Washington State Water Research Center, Pullman.
For primary bibliographic entry see Field 06E.
W72-03971

COMPUTER AND PHYSICAL MODELS FOR SOLVING SUBSURFACE PROBLEMS IN HYDROLOGY,
Wisconsin Univ., Madison, Water Resources Center.
For primary bibliographic entry see Field 02F.
W72-03990

PREDICTION OF SEASONAL-LOW STREAMFLOW, QUANTITIES,
Oregon State Univ., Corvallis. Water Resources Research Inst.
For primary bibliographic entry see Field 02E.
W72-04094

4B. Groundwater Management

ARTIFICIAL RECHARGE OF STORM RUNOFF AT KAHLUI, MAUI,
Hawaii Univ., Honolulu.
D. R. Hargis.
University of Hawaii, M S Thesis, May 1971. 79 p, 21 fig, 4 tab, 40 ref, 1 append. OWRR-A-023-HI (2).

Descriptors: Artificial recharge, Ghyben-Herzberg lens, Basalt aquifer, Storm runoff, Water quality, Pumping tests, Injection tests, Hawaii.

Storm runoff and ground water samples were analyzed for chloride, nitrate, phosphate, chemical oxygen demand, fecal coliform, total solids, and dissolved solids. Suspended solids were determined by calculation. Quality of the storm runoff from the Kahului area is generally good, with low dissolved solids and low chloride concentrations. Some fecal coliform will undoubtedly be introduced into the aquifer during injection of storm runoff. However, dilution of the injected runoff by the ground water, and the hostile environment presented by the saline water in the disposal zone, will reduce the hazard represented by the high fecal coliform counts obtained for some runoff samples from the Kahului area. The general effects of injecting storm runoff into the ground water body will be to decrease the dissolved solids concentration of the ground water in the vicinity of the wells. Pumping and injection tests of one disposal well and one test hole indicate that disposal wells should be able to inject at rates in excess of 5500 gallons per minute, if significant clogging from sediment does not occur, and if hydraulic interference between four disposal wells operating simultaneously is not significant. Data obtained during injection tests indicate a gross velocity in the aquifer in the immediate vicinity of the disposal wells of approximately one foot per minute. The general direction of ground water flow in the area is northeast. (Hargis-Hawaii)
W72-03529

EXPLOITATION OF GROUNDWATER FOR AGRICULTURAL PRODUCTION IN ARID ZONES,
Food and Agriculture Organization of the United Nations, Rome (Italy). Land and Water Development Div.
For primary bibliographic entry see Field 03F.
W72-03666

A REGIONAL BIBLIOGRAPHY OF CALCRETE,
Oxford Univ. (England). School of Geography.
For primary bibliographic entry see Field 03F.
W72-03675

A CHANCE-CONSTRAINED APPROACH TO THE CONJUNCTIVE USE OF SURFACE WATERS AND GROUNDWATERS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Environmental Resources.
For primary bibliographic entry see Field 04A.
W72-03681

INTERPRETATION OF ELECTRICAL RESISTIVITY LOGS IN A TWO-ZONE CYLINDRICALLY SYMMETRIC GEOMETRY,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 08A.
W72-03762

DYNAMIC PROGRAMMING MODEL AND QUANTITATIVE ANALYSIS, ROSWELL BASIN, NEW MEXICO,
New Mexico Inst. of Mining and Technology, Socorro. Hydrology Section.
For primary bibliographic entry see Field 02F.
W72-03770

THE ARTESIAN SYSTEM IN GEORGIA: STRATIGRAPHY AND HYDROLOGY OF THE OCALA,
Georgia Univ., Athens. Dept. of Geology.
Robert E. Carver.
PB-206 217. Completion Report, December 1971. 6 p. OWRR A-006-GA (4).

Descriptors: *Stratigraphy, *Hydrogeology, *Aquifer recharge, *Aquifer pressures, Hydraulic gradient, Aquifer characteristics, Aquifers, Artesian pressures, Opal-Montmorillonite mixtures, Permeability, *Georgia, Southeast U.S., *Confined water, *Petrography.
Identifiers: *Coastal plain aquifer, *Ocala limestone, *Jackson Group.

The report summarizes studies (1) to determine the lithology and distribution of the Ocala limestone and its correlative units within Georgia, (2) to determine the basic hydrology and recharge characteristics of the coastal plain aquifer, and (3) to determine the effect of long-term use of the aquifer on aquifer pressures. Results of the studies are included in a summary report and a series of papers and abstracts dealing with the (1) stratigraphy, (2) physical properties, and (3) hydrogeology of the aquifer. New information is provided on the relation of individual rock units in Georgia and South Carolina to each other and the aquifer as well as a better understanding of the functioning of the aquifer. No rock units within the outcrop or near-surface area of the aquifer were found sufficiently impermeable or of lateral extent to be a major barrier to aquifer recharge. Analysis of data on ressures in the aquifer, covering a period of 50 to 70 years showed the effects of pumping at high water-usage sites along the coast are regional as well as local. (Conway-Georgia)
W72-03772

GROUND-WATER AND GEOHYDROLOGIC CONDITIONS IN QUEENS COUNTY, LONG ISLAND, NEW YORK,
Geological Survey, Washington, D.C.
J. Soren.
Available from GPO, Washington, D.C. 20402 - $1.25 (including plates). Geological Survey Water-Supply Paper 2001-A, 1971. 39 p, 4 fig, 2 plate, 1 tab, 19 ref.

Descriptors: *Hydrogeology, *Water resources development, *Withdrawal, *Drawdown, *Saline water intrusion, New York, Urbanization, Water quality, Recharge, Artificial recharge, Infiltration, Water levels, Cities.
Identifiers: *Urban hydrology, *New York City, *Queens County (NY).

Queens County is a heavily populated borough of New York City, at the Western end of Long Island, N.Y. Large amounts of ground water are used, mostly for public supply. The county's aquifers consist of sand and gravel of Late Cretaceous and of Pleistocene ages in a wedge-shaped reservoir lying on a southeastward-sloping floor of bedrock. Water in the deeper aquifers ranges from poorly confined to well confined. Withdrawal averaged about 60 mgd from about 1900 to 1967. The county has been extensively paved, and storm and sanitary sewers divert water which formerly entered the ground to discharge outside the area. Natural recharge to the aquifers has been reduced to about one half of the natural rate and is below the withdrawal rate. Groundwater levels have declined more than 40 feet. The water table is below sea level in much of the county. The aquifers are contaminated by salty ground water. Thermal pollution of the ground water has occurred locally where ground water pumped for cooling uses is returned hot to the aquifer through recharge wells. (Knapp-USGS)
W72-03857

ANALYSIS OF GROUNDWATER FLOW TO DEEP WELLS IN AREAS WITH A NON--LINEAR FUNCTION FOR THE SUBSURFACE DRAINAGE,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 02F.
W72-03865

GEOLOGY AND GROUNDWATER CONDITIONS OF PARTS OF NAINITAL DISTRICT, UTTAR PRADESH,
Geological Survey of India, Calcutta.
B. D. Pathak, D. K. Dutt, K. R. Karanth, A. L. Kidwai, and A. P. Rao.
India Geological Survey Bulletins, Series B, Engineering Geology and Groundwater, No 24, 1967. 42 p, 6 fig, 4 plate, 7 tab, 11 ref, 7 append.

Descriptors: *Water resources development, *Groundwater, *Water wells, *Hydrogeology, *Foreign projects, Aquifers, Hydrologic data, Data collections, Aquifer characteristics, Pumping, Water yield, Water quality, Groundwater recharge, Chemical analysis, Water table.
Identifiers: *India.

The area of groundwater investigation in the Nainital district in India is located between Tanakpur and Thakurdwara. In the Pipalsana and Sarwarkhera exploratory wells, groundwater was under sufficient pressure to rise above land surface 30.48 and 129.24 meters (100 and 424 feet) below ground level respectively. The quality of

water was suitable for irrigation purposes. The results of groundwater exploration in the area indicate that large quantities of artesian water could be made available by constructing sufficiently deep tubewells. The piezometric head in confined aquifers in the northern part of the terai is relatively higher than that in the southern part; and the artesian aquifers occur at comparatively shallow depths. (Woodard-USGS)
W72-03879

GROUND WATER FOR PLANNING IN NORTHWEST OHIO, A STUDY OF THE CARBONATE ROCK AQUIFERS.
Ohio Dept. of Natural Resources, Columbus. Div. of Water.
For primary bibliographic entry see Field 06D.
W72-03975

THE NORTHWEST OHIO WATER DEVELOPMENT PLAN.
Burgess and Niple Ltd., Columbus, Ohio.
For primary bibliographic entry see Field 06D.
W72-03976

OUACHITA RIVER BASIN IN ARKANSAS,
Arkansas Soil and Water Conservation Commission, Little Rock.
R. G. Andrews, and E. A. McRae.
July 1970. 89 p, 27 fig, 23 tab.

Descriptors: *Water supply, *Water quality, *Flood control, *Arkansas, *Planning, Agriculture, Industries, Municipal wastes, Dams, Rainfall, Hydrology, Watershed management, Runoff, Human population, Oil, Subsurface water, Reservoirs, Administration, Recreation, Water pollution, Mineralogy, Water sources, Aquifers.

A preliminary appraisal is presented of the water and related resources of the Ouachita River Basin in south-central Arkansas. The basin comprises an area of 11,548 miles, and in 1960 its population was about 367,000. With an average annual precipitation of 52 inches, the basin is rich in water resources. The quality of the water is excellent for the most part, but man-made pollution has depleted the quality in some areas. Although municipal wastes have been a problem in the past, regulatory actions have greatly improved the situation. Frequent periods of high precipitation and the resulting rapid runoff cause flash floods in tributary streams; but, due to extensive flood control works, major problems have been averted. With proper management, available supplies are adequate to meet all foreseeable needs. Based on population growth and industrial and agricultural expansion, future requirements will be as much as 5 million acre-feet annually by the year 2020. This amount is less than one half the annual average surface runoff. The quality of water in future years may be more of a problem than quantity. The development of underground water supplies, additional reservoir sites, small watershed projects, land use regulations, and pollution control are recommended. (Poertner)
W72-03980

WATER SUPPLY AND TREATMENT IN THREE EUROPEAN COUNTRIES,
North Carolina Univ., Chapel Hill. School of Public Health.
D. A. Okun.
Journal of the American Water Works Association, Vol 54, No 6, p 650-656, June 1962, 3 fig.

Descriptors: *Water treatment, *Ground water recharge, *Filtration, *Disinfection, Iron, Manganese, Taste, Odor, Coagulation, Sedimentation, Water supply, Water resources.
Identifiers: *European countries.

About half of the 13,000 sq mi Netherlands is below sea level. Water for Amsterdam, Northern Holland and the Hague is pumped from the Rhine River, rapid sand filtered then pumped into the dune areas which provide considerable treatment as the water percolates through the sand. Water withdrawn from the dunes is aerated, rapid sand filtered and disinfected before being discharged to the distribution system. Only Rotterdam is limited to treating the water directly from the Rhine. The plant includes rapid sand filtration, slow sand filtration, chlorination, and taste and odor control. A new plant includes ferric sulfate coagulation and rapid sand filtration. At Dortmund in the Ruhr district, Germany, water from the Ruhr River is permitted to percolate into the aquifer for withdrawal through wells. At Essen the slow sand effluent percolates to the aquifer. It is traditional in Europe to take the water from underground sources when possible. At Berlin water pumped from wells on the shores of lakes is treated for iron and manganese removal by aeration, sedimentation and rapid sand filtration, using sand of more than 1 mm size, and air and water in backwashing. London, England pumps water from the Thames into reservoirs providing about 75 days retention to remove suspended matter and microorganisms. This is followed by preliminary rapid sand filtration, then slow sand filtration and chlorination. At the Ashford Common Plant, microstraining is used instead of rapid sand filtration. (Bean-AWWA)
W72-04075

4C. Effects on Water of Man's Non-Water Activities

MODELING OF HYDROLOGIC PROCESSES AND WATER SALVAGE PROCEDURES IN SEMIARID REGIONS,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 02A.
W72-03527

GROUND-WATER AND GEOHYDROLOGIC CONDITIONS IN QUEENS COUNTY, LONG ISLAND, NEW YORK,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04B.
W72-03857

ENVIRONMENTAL GUIDELINES FOR ROAD CONSTRUCTION IN ALASKA,
Environmental Protection Agency, College, Alaska, Alaska Water Laboratory.
Frederick B. Lotspeich.
Available from the National Technical Information Service as PB-206 155, $3.00 in paper copy, $0.95 in microfiche. EPA Report No. 1610 GOI, August 1971, 127 p, 53 fig, 26 ref, 4 append. EPA Program 1610 GOI 09/71.

Descriptors: *Alaska, *Environmental effects, Highways, *Road construction, Road design, Roadbanks, *Tundra, *Cold regions, Soil surfaces, *Frozen soils, Environmental engineering, Melting, Melt water, Saturated soils, Erosion control.
Identifiers: Environmental guidelines.

The purpose is to compile and describe the best practical measures required to assure environmental protection during road construction under cold climate conditions. This report summarizes accepted road construction methods for Alaska which, if followed, will help to minimize environmental degradation. Significant conclusion include: 1. When building roads do not disturb the tundra, place gravel or other insulating material directly on undisturbed vegetation. Experience has shown that this method will minimize melting under and along the road. 2. Where melting has occurred do not drain away the water. Let it remain in the meltpond to freeze when cold weather returns. Because of very high ice content of tundra soils, removal of meltwater effectively causes loss of large volumes of surface soil. Subsequent seasonal melting then causes more soil removal which continues the cycle. 3. On flat tundra install sufficient drains under elevated roads to carry runoff from summer showers, otherwise this water ponds up on the upper side and can cause melting or washouts. The tundra slopes gently to the north and even small showers can result in large runoff because of the frozen subsoil and saturated soils. (EPA abstract)
W72-03984

4D. Watershed Protection

SEEDLING SURVIVAL ON EROSION CONTROL TREATMENTS IN A SALT DESERT AREA,
Utah State Univ., Logan. Dept. of Range Science.
R. W. Wein, and N. E. West.
Journal of Range Management, Vol 24, No 5, p 352-357, September 1971. 3 fig, 17 ref.

Descriptors: *Erosion control, *Treatment, *Arid lands, *Land management, *Flood control, Soil-water-plant relationships, Plant growth, Seeds, Emerging vegetation stage, Soil conservation, Soil stabilization, Terracing, Vegetation establishment, Watershed management, Saline soils, Surface runoff, Sediment transport, Soil moisture, Crop response, Rainfall, Seasonal, Forecasing, Wheatgrasses, Gullies, Contour furrows, Drowning.
Identifiers: *Seedling survival.

Mechanical land treatments in arid regions may reduce runoff, decrease sediment and surface-water movement, and increase soil-moisture storage for plant establishment and use. Seedling emergence and soil moisture is examined to determine the contribution of spring rains to seedling survival and to predict where plants would persist on erosion-control structures. Counts of seeded crested wheatgrass and volunteer species were made on gully plugs and contour furrows. Plant emergence in the summer, survival rates, and soil surface moisture were determined. Winter and early spring precipitation stimulated seedling emergence. Drowning was apparent in gully plug bottoms, structure slopes retained little water during storms, and soil moisture was quickly depleted. Summer storms produced soil moisture which determined seedling survival patterns around furrows. Irregular rainfalls, high evaporation, and poor infiltration reduced the effectiveness of summer rains. Soil moisture benefitted seedlings only at the high water line of the gully plug retention dam at the bottom of furrows. (Popkin-Arizona)
W72-03712

THE CONTROL OF EROSION: SUGGESTIONS FOR FUTURE ACTION WITH PARTICULAR REFERENCE TO PATAGONIA,
Buenos Aires Univ. (Argentina). Facultad de Ciencias Exactas y Naturales.
Horacio E. Bosch.
Cienc Invest. 26 (11/12): 502-508. Illus. 1970.
Identifiers: Control, Erosion, Patagonia.

Erosion by water has occurred in times past throughout Patagonia with the exception of the extreme south. In the high mountainous regions the effects of erosion have been most pronounced. The effect of more recent erosion by water can be observed in the accumulation of sediment in water courses and in the deposits formed after rain. Rivers like the Mirihuao and Comallo transport enormous quantities of soil materials during certain periods. The past and present effects of water erosion are reviewed. The losses thus sustained are considerable, and action to control them is imperative.--Copyright 1971, Biological Abstracts, Inc.
W72-03800

A COMPILATION OF FLOOD ABATEMENT PROJECTS IN OREGON,
Oregon State Univ., Corvallis. Water Resources Research Inst.
R. E. Emmer, and K. W. Muckleston.
Available from the National Technical Information Service as PB-206 307, $3.00 in paper copy, $0.95 in microfiche. Report WRRI-11, December 1971. 112 p, 59 fig, 3 tab, 59 ref. OWRR A-013-ORE (1).

Descriptors: *Flood control, *Flood protection, Watershed management, Oregon, Watersheds, River basins.

This report is an inventory and reference to flood abatement projects in Oregon. Maps, location, capacity, and type of flood abatement projects in Oregon are included. A chapter for each watershed contain a description of its characteristics of topography, geology, climate, river regime, and flooding patterns within the basin. Flood abatement projects are engineering structures which are built and/or operated to control flood waters, e. g. levees, reservoirs, channel improvements, spillways etc. Only those projects specifically designed for flood control are described. (Wilson-Oregon)
W72-04093

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

NUCLEAR TECHNIQUES IN ENVIRONMENTAL POLLUTION.
International Atomic Energy Agency, Vienna (Austria).

Available from Unipub, Inc. P.O. Box 433, New York, N.Y. 10016. IAEA-SM142a, Vienna, Austria, 1971. 808 p.

Descriptors: *Environment, *Pollutants, *Air Pollution, *Water pollution, *Water pollution sources, *Radioactivity, Radioisotopes, Water pollution control, Sampling, Analytical techniques, Sediments, Tracers, Diffusion, Dispersion, Discharge measurements, Sediment transport, Aquatic life.
Identifiers: Concentration, Fuel reprocessing, IAEA, Siting.

Due to serious public concern over pollution problems, the International Atomic Energy Agency convened a Symposium on the Use of Nuclear Techniques in the Measurement and Control of Environmental Pollution in Salzburg on 26-30 October 1970. One hundred and seventy-seven scientists from 33 countries and nine international organizations attended the meeting and 54 papers were presented on the analysis and dispersion of air and water pollutants, mercury contamination problems, coastal pollution and sewage disposal. (Houser-ORNL)
W72-03521

EXPERIENCE GAINED FROM THE CONTROLLED INTRODUCTION OF LIQUID RADIOACTIVE WASTE TO COASTAL WATERS,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Radiobiological Lab.
A. Preston, D. F. Jefferies, and N. T. Mitchell.
In: STI-PUB-268 (IAEA SM-142a, CONF 701023, Nuclear Techniques in Environmental Pollution, Vienna, 1971, p 629-644. 7 fig, 5 tab, 12 ref.

Descriptors: *Nuclear powerplants, *Fuels, *Effluents, *Pollutants, *Water pollution, *Water pollution control, *Water pollution effects, *Water pollution sources, Oceans, Nuclear reactors, Nuclear wastes, Waste disposal, Diffusion, Distribution, Distribution pattern, Data collections.
Identifiers: Fuel reprocessing, Atlantic Ocean, Concentration, Liquid waste.

The behaviour of specific radionuclides discharged in a continuous, routine and controlled manner from established marine outfalls is described, together with the equilibrium levels found in the environment. The examples include the discharge from the United Kingdom Atomic Energy Authority fuel reprocessing plant at Windscale and from the Bradwell nuclear power station of the Central Electricity Generating Board; these and other examples provide evidence of the behaviour of a range of radioactive pollutants, principally the nuclides of metals. The way in which experience from these controlled disposals may be applied to other problems of pollution, including chemical pollution are examined. In the United Kingdom major discharges of radioactive liquid effluents are regularly introduced, under strictly controlled conditions, to coastal or estuarine waters at fifteen locations. At two of these the effluents originate from spent fuel processing and the principal radio-nuclides discharged are the fission products ruthenium-106, zirconium-95, niobium-95, cerium-144, caesium-137, caesium-134, strontium-90 tritium. At the other locations the effluent originates from nuclear power reactors and consists mainly of the fission products caesium-137 and caesium-134, and such neutron-induced radio-nuclides as zinc-65, cobalt-60, iron-55, antimony-124, silver-110m, chromium-51 and tritium. (Houser-ORNL)
W72-03522

CATALOG OF PESTICIDE NMR SPECTRA,
Environmental Protection Agency, Athens, Ga. Southeast Water Lab.
A. L. Alford, and L. H. Keith.
Available from GPO as PB-206 144 NTIS $0.95 in microfiche. Environmental Protection Agency-Research and Monitoring, Water Pollution Control Research Series, April 1971. 163 p, 144 fig, 2 tab, 11 ref. EPA Program 16020 EWC.

Descriptors: *Organophosphorus pesticides, *DDT, *Carbamate pesticides, *Nuclear magnetic resonance, Pesticides, Spectroscopy, Pollutant identification, Diazinon.
Identifiers: *Chemical shifts, *Coupling constants, Spin decoupling, Metabolites, NMR spectra, Malathion, Malaoxon, Cygon, Dimethoxon, Meta-Systox-R, Dibrom, Neguvon, DDVP, Ciodrin, Azodrin, Bidrin, Phosdrin, Phosphamidon, Methyl Trithion, Guthion, Guthion oxygen analog, Imidan, Tiguvon, Abate, Ronnel, Gardona, Methyl parathion, Sumithion, Dicapthon, Ruelene, Zytron, Thimet, Di-Syston.

Nuclear magnetic resonance spectra have been recorded, interpreted, and published for organophosphorus pesticides, DDT and related compounds, and carbamate pesticides and some of their degradation products. A Varian HA-100 NMR spectrometer with a variable-temperature probe and a homonuclear spin decoupler was used to record the spectra of 114 compounds. Chemical shifts and coupling constants are shown for each spectrum. The chemical name and source of each pesticide are listed. (Holoman-Battelle)
W72-03541

QUALITATIVE COMPOSITION OF PHYTOPLANKTON IN THE VICINITY OF NEWFOUNDLAND,
All-Union Research Inst. of Marine Fisheries and Oceanography, Moscow (USSR).
O. A. Movchan.
Okeanologiya, Vol. 10, No. 3, p 381-387, May-June 1970. 5 fig, 16 ref.

Descriptors: *Phytoplankton, *Algae, *Diatoms, *Currents, *Distribution patterns, Atlantic Ocean, Pacific Ocean, Tropical regions, Polar regions, Cyanophyta, Chrysophyta, Pyrrophyta, Sampling, Ecology, Water temperature.
Identifiers: Newfoundland, Peridinians, Qualitative composition, Coscinosira polychorda, Thalassiosira decipiens, Thalassiosira gravida, Thalassiosira nordenskioldii, Thalassiosira rotula, Schroderella delicatula, Dactyliosolen mediterraneus, Leptocylindrus danicus, Rhizosolenia fragilissima, Rhizosolenia hebetata f. semispina, Chaetoceros affinia, Chaetoceros atlanticus, Chaetoceros borealis.

Among the phytoplankton collected in the 590 samples taken by the ship R/V Mikhail Lomosov from its stations off Newfoundland were 131 species and varieties of algae, 25 genera and 67 species of diatoms, 15 genera and 50 species of peridinians, 6 genera of coccolithines, 4 species of protococcuci, 2 species of silico flazellates, 1 species of Heterocontae and 1 species of blue-green algae. Fifty percent of the types of diatoms are massive (over 1 million cells/cu m in the 0- to 100-m layer). Study of the ecology and the geographic distribution of the phytoplankton showed abundance of tropical species but few arctic-boreal species south of 42 degrees N. North of this was a zone of mixing of tropical and arctic-boreal species. The cosmopolite species was widely spread in the Newfoundland region. Similarities were found in the composition of the phytoplankton in the region of Newfoundland and in adjacent waters in the Northwestern Atlantic and Northwestern Pacific. Investigation of the distribution of the neritic and oceanic forms of diatoms and a few species of peridinians showed the influence of currents and the mixing of waters from polar and tropical zones on abundance. Maps show the concentration of species, their geographical location, and seasonal variation. (Little-Battelle)
W72-03543

QUANTITATIVE DISTRIBUTION OF PLANKTONIC FORAMINIFERA IN ATLANTIC OCEAN SEDIMENTS,
Akademiya Naul SSSR, Moscow. Institut Okeanologii.
N. V. Belyayeva.
Okeanologiya, Vol. 10, No. 6, p 820-830, November-December 1970. 1 fig, 7 tab, 53 ref.

Descriptors: *Protozoa, *Plankton, *Atlantic Ocean, *Distribution patterns, Latitudinal studies, Continental shelf, Basins, Benthic fauna, Gulf of Mexico, Sediments.
Identifiers: *Foraminifera, Boreal, Notalian, Globigerinidae, Globorotaliidae, Mediterranean, North America, Africa, South America, Globigerinoides, Globigerina pachyderma, Globigerina bulloides, Globigerinita glutinata, Globoquarrina quinqueloba, Globorotalia inflata, Orbulina universa.

Low concentrations of planktonic Foraminifera are found on the continental shelves of all the latitudinal zones and on the upper part of the continental slope at high latitudes. This distribution is related to the low concentration of these organisms in the water above the shelves and to terrigenous dilution. Their abundance increases with depth. Maximum concentrations occur on underwater ridges and swells and on the ocean floor at depths not exceeding the 'critical' ones. The 'critical' depth ranges from 3500 to 4000 m at high and from 4500 to 5000 m at low latitudes. No planktonic Foraminifera have been found on the bottom of deep-sea basins at depths of more than 4000 m in the boreal and notalian regions or at depths of more than 5000 m in the tropics. A figure and tables present data which show how the planktonic foraminiferans are distributed in the areas studied. (Holoman-Battelle)
W72-03546

POPULATION, ACTIVITY, AND PRODUCTION OF BACTERIA IN BOTTOM SEDIMENTS OF THE CENTRAL PACIFIC,
Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod.
Yu. I. Sorokin.

Okeanologiya, Vol. 10, No. 6, p 853-863, November-December 1970. 4 fig, 6 tab, 18 ref.

Descriptors: *Distribution patterns, *Biochemical oxygen demand, *Bacteria, *Biomass, Sediments, Pacific Ocean, Productivity, Temperature, Benthic fauna, Population, Primary productivity.
Identifiers: Central Pacific, Chemosynthesis, Saprophytic bacteria, Biosynthesis, Fiji Islands, Tahiti, Japan, Fanning Island.

Analyses of bacterial populations including their functional activity, production, and destructive activity were carried out in the main types of bottom sediments ranging from coral sand to deep-sea red clay. The analyses involved: (1) assessment of the total number and biomass of the bacteria and the number of saprophytic bacteria; (2) determination of the assimilation of CO2 by the bacteria and subsequent calculation of bacterial production (chemosynthesis); and (3) determination of the comparative biochemical oxygen demand (BOD) in the sediments. It was found that the patterns of distribution of the bacterial population, activity, and products correlate well with the general zones of the ocean, both biological and geological. Active bacterial processes are shown to be limited to the surface layer of the bottom sediments in shallow water and on island slopes. Bacterial activity and production are 100-fold lower in pelagic sediments than in shallow water due to low temperature and probably the absence of free oxygen. The above confirms the BOD determinations which showed that there is an insignificant quantity of reduced compounds in the bottom sediments. (Holoman-Battelle)
W72-03547

THE RELATIVE IMPORTANCE OF NANNOPLANKTON AND NETPLANKTON AS PRIMARY PRODUCERS IN TROPICAL OCEANIC AND NERITIC PHYTOPLANKTON COMMUNITIES,
Stanford Univ., Pacific Grove, Calif. Hopkins Marine Station.
T. C. Malone.
Limnology and Oceanography, Vol. 16, No. 4, p 633-639, July 1971. 2 fig, 3 tab, 28 ref.

Descriptors: *Nannoplankton, *Aquatic productivity, *Phytoplankton, *Fluorometry, Pacific Ocean, Chlorophyll, Filters, Neritic, Sea water, Growth rates, Sampling, Primary productivity, Absorption.
Identifiers: Netplankton, Caribbean Sea, Pheopigment, van Dorn bottles, Chlorophyll a.

Nannoplankton and netplankton primary productivity and standing crop were measured in a wide variety of neritic and oceanic environments in the eastern tropical Pacific and Caribbean region. Water samples were collected 3 hours before local apparent noon from 2 meters below the surface with van Dorn bottles. Incubation in light and dark bottles and a filtering technique were used to measure carbon uptake. Chlorophyll a and pheopigment concentrations were measured by a fluorometric technique. Surface NO3-Nitrogen concentrations were also measured using an Autoanalyzer, and the mixed layer depths were determined from BT and STD casts. Nannoplankters were the most important producers in both neritic and oceanic environments. Netplankton productivity was significantly higher in neritic waters. Mean neritic netplankton-nannoplankton productivity and chlorophyll ratios were significantly higher than those observed in oceanic waters. The relative importance of the netplankton fraction was not systematically related to phytoplankton productivity. It was concluded that the patterns of variation in the relative importance of netplankton and nannoplankton could be accounted for by the high netplanktor growth rates and low grazing pressure indices observed in neritic waters. (Mortland-Battelle)
W72-03548

BIOLUMINESCENCE AND PHYTOPLANKTON SUCCESSIONS IN BAHIA FOSFORESCENTE, PUERTO RICO,
Johns Hopkins Univ., Baltimore, Md.
For primary bibliographic entry see Field 05C.
W72-03550

AVAILABLE IRON: A LIMITING FACTOR FOR MARINE PHYTOPLANKTON,
Washington Univ., Seattle. Dept. of Oceanography.
J. Lewin, and C. -H. Chen.
Limnology and Oceanography, Vol. 16, No. 4, p 670-675, July 1971. 5 tab, 14 ref.

Descriptors: *Iron, *Cultures, *Sea water, *Phytoplankton, Washington, Nutrients, Filters, Colorimetry, Growth rates.
Identifiers: Hood Canal, Coccolithus huxleyi, Platymonas suecica, Amphidinium carterae, Isochrysis galbana, Skeletonema costatum, Cyclotella nana, EDTA, Phaeodoetylum tricornutum.

Experiments on the availability of iron in culture media have been carried out using seawater from Hood Canal, Washington. When all nutrients (except for Fe-EDTA) were added and the culture medium was autoclaved, the iron present in the seawater was unavailable for growth of most of the six phytoplankton species studied. EDTA was effective in making such iron available for algal growth in culture media made with freshly collected seawater but not when the water had been stored some days. Both in stored seawater and in autoclaved culture medium, part of the solution iron was converted into a particulate form. (Mortland-Battelle)
W72-03552

ANALYSES OF SPECIES DENSITIES BY THE MULTIVARIATE GENERAL LINEAR MODEL,
Smithsonian Institution, Washington, D.C. Museum of Natural History.
For primary bibliographic entry see Field 07C.
W72-03554

RESIDUES IN FISH, WILDLIFE, AND ESTUARIES - ORGANICHLORINE INSECTICIDE RESIDUES IN FISH - FALL 1969, NATIONAL PESTICIDE MONITORING PROGRAM,
Bureau of Sport Fisheries and Wildlife, Washington, D.C.
C. Henderson, A. Inglis, and W. L. Johnson.
Pesticides Monitoring Journal, Vol. 5, No. 1, p 1-11, June 1971. 1 fig, 4 tab, 15 ref.

Descriptors: *DDT, *Dieldrin, *Monitoring, *Pesticide residues, *Heptachlor, Fish, Chlorinated hydrocarbon pesticides, Separation techniques, Gas chromatography, Yellow perch, Suckers, White catfish, White perch, Bass, Bullheads, Carp, Channel catfish, Sunfishes, Mullets, Walleye, Drums, Lake trout, Buffalo fishes.
Identifiers: DDE, TDE, Lindane, BHC, White suckers, Chain pickerel, Goldfish, Heptachlor epoxide, Arochlor 1254, Biological samples, Pumpkinseed, Largemouth bass, Brown bullhead, Gizzard shad, Spotted suckers, Striped mullet, Rock bass, Freshwater drum, Bloater, Lake whitefish, White crappies, Bigmouth buffalo, Smallmouth bass.

The fish monitoring program conducted by the Bureau of Sport Fisheries and Wildlife since 1967 was continued in 1969. A total of 147 composite fish samples were collected at 50 nationwide monitoring stations during the fall of 1969. Each sample was analyzed by a commercial laboratory for residues of 11 organochlorine insecticides, lipids, and polychlorinated biphenyls (PCB's). DDT and/or metabolites were found in all samples with residue levels of total DDT (DDE plus TDE plus DDT) ranging from 0.03 to 57.8 ppm (mg/kg, wet weight, whole fish). Dieldrin residues ranging from 0.01 to 1.59 ppm were found in all but 10 of the 147 samples. Other organochlorine insecticides were found less frequently. Confirmatory analyses were conducted on some samples, and studies were made to determine effects of PCB's on insecticide residue analyses. This monitoring program was expanded in 1970 to include 50 more stations throughout the U.S. Many states, in addition to participating in this monitoring program, have established their own programs to monitor fish from other waters. (Mortland-Battelle)
W72-03555

A FRESHWATER 'RED TIDE' ON CLEAR LAKE, CALIFORNIA,
California Univ., Davis. Inst. of Ecology; California Univ., Davis. Dept. of Zoology.
A. J. Horne, P. Javornicky, and C. R. Goldman.
Limnology and Oceanography, Vol. 16, No. 4, p 684-689, July 1971. 1 fig, 1 tab, 16 ref.

Descriptors: *Dinoflagellates, *Lakes, *Turbidity, *Red tide, California, Chlorophyll, Sampling, Spectrophotometry, Photosynthesis, Nitrogen fixation, Water temperature, Daphnia.
Identifiers: Peridinium pernardii, Clear Lake, Aphanizomenon flos-aquae, Pyroheliometer, Nephelometer, Chlorophyll a.

A short-lived freshwater 'red tide' of Peridinium pernardii (dinoflagellates) occurred in Clear Lake, California, between late March and mid-May 1970, confined to a zone of high concentration in shallow water around the lake's margin. Densities reached at least 5,000 cells/ml and at least 130 micrograms/liter chlorophyll a. The red tide is attributed to winter floods followed by a calm period with clear skies that provided dissolved organic material and high insolation. It is postulated that the high inorganic turbidity present at this time prevented rapid growth of the spring-summer dominant alga Aphanizomenon flos-aquae but did not preclude the bloom of P. pernardii because of its phototactic mobility. No toxic effects were noted on the flora and fauna of the lake. (Mortland-Battelle)
W72-03559

ACANTHARIA IN THE ATLANTIC OCEAN, THEIR ABUNDANCE AND PRESERVATION,
Parma Univ. (Italy).
E. M. Bottazzi, and B. Schreiber.
Limnology and Oceanography, Vol. 16, No. 4, p 677-684, July 1971. 3 tab, 15 ref.

Descriptors: *Plankton, *Sea water, *Sampling, Atlantic Ocean, Plankton nets, Systematics, Strontium radioisotopes.
Identifiers: *Sample preservation, Acantharia, Foraminifera, Radiolaria, Amphilonche elongate, Dorataspids, Cerium, Nuclides, Formaldehyde, Sarcodina.

Acantharia are among the least studied marine plankton and have generally been considered rare. The preservation of these organisms has also been considered quite difficult. In this study, No. 10-mesh net samples were taken from the Atlantic Ocean and preserved in buffered seawater-formaldehyde. Erosion of the Acantharia spicules was not usually sufficient to interfere with their taxonomic study, although some families were more susceptible to erosion than others. The Acantharia almost always made up more than 1 percent of the organisms caught and frequently comprised 10 to 20 percent and even over 30 percent. Available data show that Acantharia are generally more abundant than Foraminifera or Radiolaria, although these groups of Sarcodina show covariance in abundance. It is also shown that Acantharia may play an important role in the marine geochemistry of fallout. (Mortland-Battelle)
W72-03560

THE APPLICABILITY OF REMOTE SENSOR TECHNIQUES FOR OIL SLICK DETECTION,
Coast Guard, Washington, D.C. Office of Research and Development.
For primary bibliographic entry see Field 07B.
W72-03561

ABUNDANCE OF ETHMODISCUS IN PACIFIC PLANKTON,
Akademiya Nauk SSSR, Moscow. Institut Okeanologii.
T. V. Belyayeva.
Okeanologiya, Vol 10, No 5, p 672-675, September-October 1970. 1 fig, 1 tab, 11 ref.

Descriptors: *Plankton, *Diatoms, *Sampling, *Distribution patterns, *Phosphates, *Aquatic populations, Maps, Mapping, Phytoplankton, Pacific Ocean, Bottom sediments, Stations, Data collections, Algae.
Identifiers: *Ethmodiscus rex, Ethmodiscus gazellae, Baja California, Hemiaulus hauckii, Stigmaphora rostrata, Ethmodiscus oozes.

A map was compiled bringing together all the scattered information on the distribution of the plankton diatom Ethmodiscus rex in the Pacific Ocean. The data were acquired mainly from analysis of samples collected during several voyages of the R/V Vityaz' in eastern, central, and western parts of the Pacific from 1955 to 1967. More than 400 sampling locations were used for the map showing the quantitative distribution of Ethmodiscus. The distribution pattern is extremely mosaic with the maximum population occurring between the equator and 5 degrees N. A relationship was shown between the distribution of Ethmodiscus and phosphate concentration, the maximum populations not coinciding with regions of highest phosphate concentration as is usually the case with most diatoms. This unusual distribution of Ethmodiscus is unexplained, but also occurs with the diatoms, Hemiaulus hauckii and Stigmaphora rostrata. The Ethmodiscus population in Pacific plankton is insignificant, averaging from 0.01 to 0.5 kl/cu m in the 0- to 100-m layer. Therefore, the present data is inconclusive on the origin of the Ethmodiscus oozes, their concentration in the western Pacific, or the mosaic pattern of their distribution. Phytoplankton samples were collected mostly with a DzhOM net with mouth opening 80 cm in diameter and aperture size in the filtering cone of about 180 microns. (Jefferis-Battelle)
W72-03567

DETERMINATION OF NANOGRAM QUANTITIES OF MERCURY BY THE REDUCTION--AERATION METHOD AND ATOMIC FLUORESCENCE SPECTROPHOTOMETRY,
Florida State Univ., Tallahassee. Dept. of Chemistry.
V. I. Muscat, and T. J. Vickers.
Analytica Chimica Acta, Vol 57, No 1, p 23-30, November 1971. 7 fig, 3 tab, 9 ref.

Descriptors: *Heavy metals, *Spectrophotometry, *Sediments, Florida, Alabama, Water analysis.
Identifiers: *Mercury, Reduction-aeration method, Atomic fluorescence spectrophotometry, Atomic absorption spectrophotometry, Mobile Bay, St. Joseph's Bay.

The usefulness of atomic fluorescence spectrophotometry coupled with the reduction-aeration method for mercury analysis was investigated by analyzing standard solutions (prepared by dissolving mercury (II) chloride in sulfuric acid and adding two drops of 5 percent (w-v) potassium permanganate solution), water samples from Mobile Bay, sediment samples from St. Joseph's Bay, Florida, and standard W-1 rock samples issued by the U.S. Geological Survey. Samples requiring digestion were treated by the permanganate-peroxydisulfate oxidation method. A Heath EU-700 scanning monochromator and an R 166 solar blind multiplier phototube were the spectrometer and detector used in the analyses. Samples were also analyzed by atomic absorption to verify the results. The results from the atomic fluorescence analysis show that the method has a detection limit of 3 ng (0.06 ppb) and that mercury can be determined at levels of 15-600 ng. The results of these analyses compared favorably with those obtained by atomic absorption. To test the long-term reproducibility of the technique, samples were analyzed twice a day over a six-day period. The relative standard deviations were 7 percent for 40 ng Hg, 3 percent for 70 and 100 ng Hg, and 2 percent for 130 ng Hg. Data from the sample analyses are included. (Little-Battelle)
W72-03568

SPACE-TIME SAMPLING OF POLLUTANTS IN AQUIFERS,
Arizona Univ., Tucson. Dept. of Hydrology.
E. E. Simpson, C. C. Kisiel, and L. Duckstein.
Paper presented at Symposium on Ground-Water Pollution, 15th General Assembly of International Union of Geodesy and Geophysics, Moscow, USSR, August 1971. 2 fig, 16 ref. OWRR B-007-ARIZ (16).

Descriptors: *Time series analysis, *Pollutants, *Aquifers, *Simulation analysis, *Distribution patterns, Poissor ratio, Stochastic processes, Data collection, Optimization, Decision making, Model studies.
Identifiers: *Input identification, *System identification.

The objective was to define problems in space-time sampling of pollutants in aquifers and to give guidelines detailing the circumstances under which mean value or deterministic sampling models are justified. Two general classes of problems were identified: input identification and system identification. Input identification is concerned with the origin of water masses in space and time when available information on system inputs and response is incomplete. System identification is concerned with the problem of relating system input and response by an appropriate model of the combined hydraulic, chemical, and thermal behavior of the aquifer. A finite-state machine (FSM) model was proposed for space-time sampling of pollutants in aquifers. Advantages of the FSM were listed. Some theoretical problems were identified to be researched for optimal sampling schemes in space and time when inputs have different kinds of randomness, when multiple inputs in space occur, and when the system is non-homogeneous in character and transient in response. (Markell-Cornell)
W72-03676

DETERGENTS AND OTHER CONTAMINANTS IN WATER SUPPLIES-1960,
Chicago South District Filtration Plant, Ill.
J. C. Vaughn.
Journal of the American Water Works Association, Vol 53, No 8, p 994-1002, August 1961. 3 fig, 22 ref.

Descriptors: *Water treatment, *Detergents, *Toxicity, *Taste, *Foaming, *Activated carbon, *Aeration, Alkylbenzene sulfonates, *Water pollution sources, Water pollution treatment.

Detergents constitute 76% of the soap-detergent market. Anionic surfactant constitute the larger part of the domestic market while cationics are used more in the industrial field. Cationics are the most toxic of the surfactants, though all should receive attention. Cups and glasses washed in household detergents and then filled with water, may have 0.78 ppm in the water, which can with free chlorine residual produce chlorphenol taste. Foaming on sewage works is common. After a long season of low flows, water works, may receive concentrations of detergents which will cause foaming and affect taste, requiring activated carbon for removal. There is no evidence that detergents have undesirable effects on septic tank digestion; the detergent is only partially reduced. Septic tank drainfields and sewage lagoons have been responsible for contaminating ground waters. Activated carbon is the most effective agent for removal. Blowing air through water to create foam and burning the foam is one removal method. Special resin columns may be used. The 'best solution' is the elimination of alkyl benzene sulfonate. Other contaminants briefly discussed are, arsenic, lead, cadmium, cyanides, radionuclides, selenium, vanadium, organic contaminants, insecticides, hepatitis virus, and phenols. (Bean-AWWA)
W72-03700

EVALUATION OF LABORATORY METHODS FOR ANALYSIS OF HEAVY METALS IN WATER,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
R. C. Kroner, D. G. Ballinger, and H. P. Kramer.
Journal of the American Water Works Association, Vol 52, No 1, p 117-124, January 1960. 8 fig, 1 tab, 5 ref.

Descriptors: *Aluminum, *Chromium, *Iron, *Manganese, *Analytical techniques, Heavy metals, Water pollution sources.
Identifiers: *Cadmium, *Copper, *Lead, Zinc.

Metals were chosen largely on the basis of frequency in water, public health significance and availability of analytical procedures. Metals as beryllium, mercury and selenium were not chosen because their presence in water in significant quantities is uncommon and reliable analytical methods are not available. For six of the eight metals (chromium, copper, iron, lead, manganese and zinc) experience and personnel competence are leading factors in obtaining accurate results. The methods currently employed for the measurement of aluminum and cadmium are not satisfactory and require improvement. (Bean-AWWA)
W72-03719

BOD DETERMINATION FOR INDUSTRIAL WASTEWATERS,
Nebraska Univ., Lincoln. Engineering Research Center.
For primary bibliographic entry see Field 05D.
W72-03739

ALGAE AND OTHER INTERFERENCE ORGANISMS IN WATER SUPPLIES OF CALIFORNIA,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
C. M. Palmer.
Journal of the American Water Works Association, Vol. 53, No. 10, p.1297-1312, October 1961. 100 ref.

Descriptors: *Water treatment, *Algae, *Taste, *Odor, *Algicides, Activated carbon, Filtration, *Toxicity, *Distribution systems, Water pollution, Water quality.

70% of all precipitation in California occurs during three winter months. Rainfall in northern California exceeds 100 in. per year; in the extreme south, 3 in. or less per year. Water of winter flows must be stored and some from wet years must be held for use in dry years, particularly as dry periods sometimes extend over a few years. Water in various areas varies greatly in physico-chemical properties, in general being soft in the north and hard toward the south. Nearly 40% of water utilized is drawn from wells and springs. The many types of algae found in California waters are listed. Reservoirs problems, aquatic animals, physico-chemical changes, taste and odor causes, treatment plant problems, infestations in distribution systems, algicides for reservoirs, activated carbon, selective draft, reservoir and canal covers, control of weeds, watershed control, control by filtration, control of organisms in distribution systems and toxic algae are discussed. (Bean - AWWA)
W72-03746

CHARACTERIZATION AND SEPARATION OF SECONDARY EFFLUENT COMPONENTS BY MOLECULAR WEIGHT.
Little (Arthur D.), Inc., Cambridge, Mass.

Copy available from GPO Sup Doc as EP2.10:16020 FEN, $0.55; microfiche from NTIS as PB-206 193, $0.95. Environmental Protection Agency Water Pollution Research Series No 16020 FEN, March 1971. 43 p, 10 fig, 5 tab, 2 ref. EPA, WQO Contract No. 14-12-886.

Descriptors: *Membrane processes, Spectrometers, Municipal water, Sewage, *Chemical analysis, *Waste identification, Chromatography, Solvent extractions, Effluents, Filtration, Analytical techniques, Separation techniques, Waste water treatment, Ultrafiltration.

Membrane ultrafiltration with a 1000 MW cutoff membrane is an effective means of separating the high and low molecular weight fractions of effluent and provides useful analytical samples for further study. Solvent extraction techniques and thin layer chromatography show promise as appropriate methods for isolating and resolving the low molecular weight effluent subfraction. While infrared spectrometry yields good spectra of various effluent fractions, most are still much too complex to be able to infer much specific information from the spectra of the complex mixture. The same is true of ultraviolet spectrometry. High resolution mass spectrometry (HRMS) shows promise for being able to obtain a great deal of specific chemical information even from still very complex mixtures. Using HRMS, the following classes of compounds have been identified in a solvent extract of the low molecular weight effluent fraction: fatty acids, aromatic acids, alkylphenylethylene oxides, chlorinated phenols, aliphatic and aromatic amines, and amides. (EPA abstract)
W72-03784

A SIMPLE, RAPID METHOD FOR DETERMINING TRACE MERCURY IN FISH VIA NEUTRON ACTIVATION ANALYSIS,
Basf-Wyandotte Chemical Corp., Wyandotte, Mich.
J. Mark Rottschafer, John D. Jones, and Harry B. Mark, Jr.
Environ Sci Technol. 5 (4): 336-338. Illus. 1971.
Identifiers: Activation, Determining, Fish, Mercury, Method, Neutron, Trace.

As a consequence of recent concern over Hg pollution in the environment, the development of simple, rapid analytical methods for the accuratic determination of trace amounts of Hg has become very important. The technique employs separation of the activated Hg as an HgCl4 (2-) complex on an anion-exchange resin and direct counting of the resulting resin. The analyses have a plus or minus 10% s.d. for tissue samples containing Hg in the 0.05-10 ppm range, and the sensitivity has an approximate 3-ppb limit for the conditions employed. Example results for Hg content in different fish species from a variety of locations and different fish organs are given. Also, the results of replicate samples analyzed by a variety of different methods and in different laboratories are compared.--Copyright 1971, Biological Abstracts, Inc.
W72-03786

SYSTEMATIC FOLLOW-UP STUDY OF THE CIRCULATION OF POLIOMYELITIC AND OTHER ENTERIC VIRUSES IN WASTE WATER,
Ustav Epidemiologie a Mikrobiologie, Prague (Czechoslovakia).
For primary bibliographic entry see Field 05B.
W72-03812

ENVIRONMENTAL CONTAMINATION BY MERCURY (HG SERIES NO. 12): I. INORGANIC AND METHYLMERCURY IN THE WASTE OF CHEMICAL FACTORIES AND RESULTING WATER POLLUTION,
Tokyo Dental Coll. (Japan).
For primary bibliographic entry see Field 05B.
W72-03814

A RAPID TECHNIQUE FOR LOCALIZING POLLUTION IN SEA AND BRACKISH WATERS (THE CONTINUOUS DETERMINATION OF DISSOLVED OXYGEN),
For primary bibliographic entry see Field 05B.
W72-03817

A NUMERICAL METHOD FOR COMPUTING EQUILIBRIA IN AQUEOUS CHEMICAL SYSTEMS,
California Inst. of Tech., Pasadena. W. M. Keck Labs.
For primary bibliographic entry see Field 02K.
W72-03852

AERIAL COLOR ANALYSES OF WATER QUALITY,
Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
For primary bibliographic entry see Field 07B.
W72-03861

MONITORING WATER POLLUTION BY REMOTE SENSING,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
For primary bibliographic entry see Field 07B.
W72-03862

AERIAL PHOTOGRAPHY FOR WATER RESOURCES STUDIES,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
For primary bibliographic entry see Field 07B.
W72-03863

EVALUATION OF INTEGRATED HYDROLOGIC MONITORING SYSTEM,
Geological Survey, Arlington, Va.
For primary bibliographic entry see Field 07B.
W72-03873

EVALUATION OF WATER QUALITY MONITORING PROGRAMS IN CALIFORNIA.
California State Water Resources Control Board, Sacramento.

February 1971. 57 p.

Descriptors: *Monitoring, *Instrumentation, *Water quality, *Administration, *California, Telemetry, Data transmission, Electronic equipment.
Identifiers: *Automatic remote monitoring.

The State Water Resources Control Board believes that a vital element in the overall water resource management effort for clean water is an appropriate statewide monitoring program to provide information necessary for management decisions. The Board submitted basic recommendations: (1) a comprehensive statewide water quality monitoring program should be designed for major waters of the State; (2) a preliminary program should precede the intensive effort in order to define objectives and scope, and develop a data management system; (3) the comprehensive program should be designed by the State Board; (4) the program should be conducted by those state agencies having monitoring responsibilities or interests and should be guided and coordinated by the State Board; (5) the advantages of automatic monitoring and remote sensing as compared to grab sampling should be considered and carefully evaluated during program design; (6) discharger self-monitoring programs should be revamped to integrate with and complement the purposes of the comprehensive program; (7) the monitoring program should be integrated with a comprehensive water quality data management system; (8) the responsibility for laboratory analyses should be recognized to provide more effective use and expansion of existing facilities to meet expanding needs in water quality control. (Poertner)
W72-03957

A COMPREHENSIVE STUDY OF SAN FRANCISCO BAY, VOLUME VIII, SUMMARY AND RECOMMENDATIONS,
California Univ., Berkeley. Sanitary Engineering Research Lab.
E. A. Pearson, P. N. Storrs, and R. E. Selleck.
California State Water Resources Control Board, Sacramento, Publication No 42, Final Report, SERL Report No 67-5, 1971. 94 p, 8 fig, 19 tab, 24 ref.

Descriptors: *Estuarine environment, *Waste disposal, *Sediments, *California, *Water quality, Analytical techniques, Plankton, Water analysis, Municipal wastes, Industrial wastes, Tides, Fisheries, Toxicity, Coliforms, Management, Effluents, Water analysis, Odor, Water temperature.
Identifiers: *San Francisco Bay, Benthic animals, Biostimulation, Oil and grease floatables.

The objectives and scope are described of the University of California Comprehensive Investigation of San Francisco Bay. A summary of the methods used in the study and a listing of the principal conclusions and recommendations that resulted from the study are also included. The area under investigation extended from Coyote Creek in the southernmost portion of the Bay to the Antioch Bridge. The investigation was designed to determine existing water and sediment quality for quantitative inventory of waste discharges to the Bay, and to determine the effect or influence of significant waste discharges on the aquatic environment. The data collected during the four years of the investigation (1960-1964) provide a comprehensive picture of the conditions existing in San Francisco Bay during that period. The examination of the levels of the traditional water quality parameters during the period of the study does not reveal major water quality problems except in the southern portions of the Bay. However, toxicity, biostimulation, oil and grease floatables, and coliform bacteria were the disturbing conditions that were revealed after a more extensive analysis of the data. The success of the study was a result of the development of new and improved sampling and analytical methods for water and sediment quality parameters. (Poertner)
W72-03958

AN ENVIRONMENTAL MONITORING PROGRAM FOR THE SACRAMENTO-SAN JOAQUIN DELTA AND SUISUN BAY,
Stanford Research Inst., Menlo Park, Calif.
Leo W. Weisbecker, James L. Mackin, Allen W. Knight, and Robert W. Brocksen.
California State Water Resources Control Board, Sacramento. Publication No 40, May 1970. 154 p, 17 fig, 12 tab, 79 ref. SRI Proj. No EGH-8445. Contract 9-2-32.

Descriptors: *Monitoring, *Water quality, *California, *Instrumentation, *Data collections, Bay, Deltas, Telemetry, Data transmission, Electronic equipment, Forecasting, Programs, Data storage and retrieval, Data processing, Computer programs.
Identifiers: *Management information system, *Sacramento-San Joaquin Delta (Calif), Suisun Bay (Calif).

The proposed resource management information system developed in this study, in response to the needs and responsibilities of the State Board, is designed to: provide feedback to the control processes; establish a water quality and environmental baseline and historical trends; and develop an understanding of the relationships between

resource uses and their effects. Minimum resource management information system needs can be met with the following monitoring program: continuous or weekly determination of 26 in-channel water quality and biological parameters for some 28 locations throughout the Delta, Suisun Bay, and San Pablo Bay; quarterly aerial surveillance photographic coverage of the Suisun Marsh to determine distribution and trends of marsh grasses as these affect suitability of the Marsh for waterfowl habitat; twice yearly aerial surveillance photographic coverage of the entire Delta to determine resource demand and use characteristics and to obtain an updated description of the Delta and an overall synoptic assessment of water quality conditions; continuous monitoring of all municipal, industrial, and agricultural waste water flow rates together with frequent sampling and determination of chemical, physical, and biological parameters that are related to receiving water quality; and data related to resource demand and use from any available source on the continuing and current basis. Computerized data processing is recommended. Capital cost: $385,000; annual operating cost: $1,033,000. (Poertner)
W72-03959

WEST VIRGINIA WATER QUALITY NETWORK.
West Virginia Dept. of Natural Resources, Charleston. Div. of Water Resources.

1971. 85 P, 1 FIG, 1 TAB.

Descriptors: *Water quality control, *West Virginia, *Water pollution control, *Water analysis, *On-site data collections, *Networks, Sampling, Water Quality Act, Waste water disposal, Water pollution sources, Waste water treatment, Municipal wastes, Industrial wastes, State governments.
Identifiers: *Water quality sampling network.

The water quality monitoring program is described operated by the State of West Virginia along with the objectives, analyses made, analytical procedures, and sampling stations. Water quality regulations and the West Virginia Water Pollution Control Act (amended 1969) are explained. Requirements for treatment and disposal of domestic and industrial wastes are summarized. Water quality sampling stations on streams and major tributaries of the State are identified as regards location. An extensive tabulation is included of water quality data taken during 1967 at the various sampling locations. The sampling program has the following specific objectives: establish trends of the chemical, physical, and biological characteristics of the water; warn of detrimental changes in the characteristics of the water; collect data useful to municipal, industrial, agricultural, recreational, and other users; bracket waste discharges and determine their types and effects upon the stream under different natural conditions; and obtain data useful in getting public action to preserve the water for beneficial use. Usually, the following properties are observed: appearance, dissolved oxygen, biochemical oxygen demand, acidity, alkalinity, chlorides, total coliform, fecal streptococcal, color, conductivity, fluorides, hardness, pH, iron, lead, nitrates, phenol, potassium, sodium, solids series, sulfates, temperature, threshold odor, turbidity, and percent saturation of dissolved oxygen. (Poertner)
W72-03965

FINAL REPORT, PROVISIONAL ALGAL ASSAY PROCEDURES.
California Univ., Berkeley. Sanitary Engineering Research Lab.
For primary bibliographic entry see Field 05C.
W72-03985

QUALITY OF STORMWATER DRAINAGE FROM URBAN LAND,
Rex Chainbelt, Inc., Milwaukee, Wis. Ecology Div.
For primary bibliographic entry see Field 05B.
W72-03995

ULTRAMICRO ANALYSIS OF EXPLOSIVES IN SEA WATER,
Naval Ordnance Lab., Silver Spring, Md.
J. C. Hoffsommer, and J. M. Rosen.
Available from NTIS, Springfield, Va. 22151 as AD-730 444 -$3.00 paper copy; 95 cents microfiche. Naval Ordnance Laboratory, Technical Report NOLTR 71-151, August 12, 1971. 12 p, 1 tab, 3 ref. Work Request WR-1-6091 NOSC.

Descriptors: *Water analysis, *Explosives, *Oceans, *Waste disposal, *Pollutant identification, Analytical techniques, Chromatography, Sampling, Sea water, Water pollution sources.
Identifiers: Munitions dumping (Oceans), Ultramicroanalysis, TNT, RDX, Tetryl.

A method is described for the quantitative analysis of TNT, RDX, and tetryl in sea water by vapor phase chromatography with the nickel-63 electron capture detector. A benzene extraction procedure is employed, using a 100 ml sea water sample. The method is capable of detecting TNT, RDX and tetryl at levels of 2, 5 and 20 parts per trillion, respectively. Sea water samples taken at two munitions dumping areas were analyzed. No explosives were found in any of the samples. (Woodard-USGS)
W72-04037

DISTRIBUTION OF C, H, N, P, FE, MN, ZN, CA, SR, AND SC IN PLANKTON SAMPLES COLLECTED OFF PANAMA AND COLUMBIA,
Puerto Rico Nuclear Center, Mayaguez.
J. H. Martin.
BioScience, Vol 19, No 10, October, 1969, p 898-901. 4 fig, 12 ref.

Descriptors: *Puerto Rico, *Panama Canal, Carbon, Hydrogen, Nitrogen, Phosphorus, Calcium, Phytoplankton, Zooplankton, Saline water, Scour, Chemical precipitation, Trace elements, Metals, *Pollutant identification.
Identifiers: *Columbia, *Gulf of Panama, *Rio Atrato, Gulf of San Miguel, Chame Bay, Zinc, Scandium.

As part of the Puerto Rico Nuclear Center's marine environmental studies, approximately 130 plankton samples were collected on both sides of the Isthmus of Panama, during the wet and dry seasons, and later analyzed for 10 elements. The elements included Fe, Mn, Zn, Ca, Sr, Sc, P, H, C and N. The elemental distribution patterns obtained from the 1300 analyses were presented with a discussion of the more important environmental factors that affect the concentration of each element. The plankton collections were made with one-half meter diameter, No 2 and No 20 nets rigged with flow meters. Only one environmental factor was of consequence: the runoff of the Rio Atrato contained great quantities of abioseston that influenced the concentration of several elements. The net collections often contained mixed phytoplankton and zooplankton populations. Ratios of C, H, N, and P within the plankton were fairly constant and hence their distribution patterns were similar. During the wet season, the Fe and Sc values were maximal where salinities were minimal, implicating runoff as the source of the high concentrations of these elements. Zn and Ca concentrations during the dry season increased or decreased in relation to plankton abundance in the No 20 net samples. The distribution of Sr was similar to Zn and Ca during the wet season. Several factors including abundant phytoplankton, scouring, and chemical processes influenced the distribution of Mn. Once the analyses were made the distribution patterns were prepared by interpolating between the values found at each station. (Biggs-Texas)
W72-04059

VOLATILE ACID PRODUCTION BY CLOSTRIDIUM BOTULINUM TYPE F,
National Communicable Disease Center, Atlanta, Ga.
For primary bibliographic entry see Field 05B.
W72-04060

5B. Sources of Pollution

CATTLE FEEDLOT RUNOFF NATURE AND BEHAVIOR,
Kansas State Univ., Manhattan. Dept. of Bacteriology.
J. R. Miner, L. R. Bernard, L. R. Fina, G. H. Larson, and R. I. Lipper.
Proceedings, Industrial Waste Conference, 21st, May 3, 4, and 5, 1966, p 834-847. 9 fig, 9 tab, 10 ref.

Descriptors: *Water pollution sources, *Surface runoff, *Cattle, *Farmwastes, Rainfall intensity, Chemical properties, Bacteria, Nitrogen, Coliform, Streptococcus, Laboratory tests, Data collection, Analysis.
Identifiers: Feedlot.

Stormwater runoff is becoming recognized as an important water pollutant. Runoff from cattle feedlots is particulary strong. Three types of experiments were conducted to evaluate the characteristics and behavior of feedlot runoff. Two feedlots (0.05 acres each) were constructed, one with a dirt surface and the second with a concrete surface. Ten head of cattle were maintained in each lot and rainfall was simulated by a series of sprinklers. The runoff was collected and tested for chemical and bacterial contamination. Tray experiments were conducted to determine bacteriological changes in manure lying on the feedlot surface. Anaerobic bottle studies were made to determine the effects of storage in deep ponds. Cattle feedlot produces a high strength waste with considerable quantities of nitrogen. Waste strength increased with low rainfall rates, warm weather and moist lot conditions. Runoff from the concrete surface lot was nearly twice as strong as from the unsurfaced lot. The bacterial nature of the stored feedlot runoff and litter changed continuously. Changes were a function of temperature and storage time. The fecal coliform: fecal streptococcus ratio does not appear to be an entirely reliable tool to identify the cause of an observed water pollution problem. (Goessling-Texas)
W72-03516

NUCLEAR TECHNIQUES IN ENVIRONMENTAL POLLUTION.
International Atomic Energy Agency, Vienna (Austria).
For primary bibliographic entry see Field 05A.
W72-03521

EXPERIENCE GAINED FROM THE CONTROLLED INTRODUCTION OF LIQUID RADIOACTIVE WASTE TO COASTAL WATERS,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Radiobiological Lab.
For primary bibliographic entry see Field 05A.
W72-03522

A SURVEY SYSTEM FOR USE IN TRACING RADIONUCLIDE-TAGGED SEDIMENT IN THE MARINE ENVIRONMENT,
Oak Ridge National Lab., Tenn. Isotopes Development Center.
F. N. Case, E. H. Acree, and R. Brashear.
In: STI/PUB/268 (Nuclear Techniques in Environmental Pollution), Vienna, 1971. p603-628. 23 fig, 2 tab, 2 ref.

Descriptors: *Sediment transport, *Radioactivity techniques, *Tracers, *Nuclear wastes, On-site data collections, Data transmission, Monitoring,

Water pollution sources, Sands, Tracking techniques, Tagging, Marking techniques, Gold radioisotopes, Beaches, Deep water, Oceanography, Computer programs, Remote sensing, Sampling, Instrumentation.
Identifiers: Environmental survey.

Survey equipment for tracing radionuclide-tagged sediment has been designed and field tested. Information can be obtained in three near-shore zones (dry beach, breaker zone, and deep water). The detector consists of four sodium-activated cesium iodide crystals enclosed in aluminum cans and mounted within a wire-mesh, rolling ball. When 1 microCi/ (sq ft) of Au-198 tracer was deposited on the bottom of a body of water, 2.3 x 10cu counts/sec were measured. The data (radiation counts from the detector, time, tow vessel location and water depth) are recorded every 2 seconds on punched tape. The detector and associated analyser provide for energy discrimination. The data-collection system and computer programs developed to provide precise location of the detector vehicle may be used with either on-bottom detectors or water-column detectors. The detector and recording equipment may be used for surveying underwater waste-disposal areas, for mapping dredging spoils, or for surveys in areas subject to contamination by nuclear wastes. (Bopp-ORNL)
W72-03523

ENVIRONMENTAL EXPERIENCE WITH RADIOACTIVE EFFLUENTS FROM OPERATING NUCLEAR POWER PLANTS,
Environmental Protection Agency, Cincinnati, Ohio.
B. Kahn, B. Shleien, and C. Weaver.
Available from Unipub, Inc. P.O. Box 433 New York, N. Y. 10016. A/CONF.49/P-087, (1971), p 3.3-29-3.3-45.

Descriptors: *Nuclear powerplants, *Effluents, *Environment, *Environmental effects, *Surveys, Measurement, Radioactivity, Radioisotopes, Fuels, Water pollution sources, Waste disposal, Waste dilution, Waste water disposal, Monitoring, Thermal pollution, Aquatic life, Hudson River, Rivers, Dispersion, Path of pollutant.
Identifiers: Surveillance Program, On-Site data Collecting, Fuel reprocessing, Connecticut River, Concentration.

Radiological surveillance activities at the eight nuclear power stations and the nuclear-fuel reprocessing plant under routine commercial operation in the U.S. are described, and current results are summarized. At each facility the operator or his contractor monitors the environment and presents findings in periodic reports to the USAEC. The appropriate state agency for public health or environmental protection also performs radiological measurements in the neighborhood of the plant, usually as part of a statewide monitoring program. The USAEC sponsors a program of independent measurements at several stations and periodic serial radiation surveillance of the environment. New York University and the Essex Marine Laboratory are evaluating possible thermal and radiological effects of liquid effluents from two of these plants on aquatic life in the Hudson and Connecticut rivers respectively. The field studies, which were initially undertaken at a fuel reprocessing plant, a boiling-water reactor, and a pressurized-water reactor that had been in operation for several years, have now been extended to include the newer and larger light-water nuclear power stations. Concurrent measurements of individual radionuclides are made within the station, at points of waste discharge, in the immediate environment, and at points of possible human exposure. Thus the magnitude of the source, the importance of paths to and through the environment, and the extent of radionuclide dispersion or concentration are indicated. (Houser-ORNL)
W72-03524

MULTIPLICATION OF CLOSTRIDIUM BOTULINUM TYPE E IN THE GREAT LAKES - CASE STUDY OF GREEN BAY, WISCONSIN,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 05C.
W72-03528

INFLUENCE OF ACID MINE WATER ON THE MICROFLORA OF SEWAGE,
West Virginia Univ., Morgantown. Water Research Inst.
H. A. Cook, and H. A. Wilson.
Available from the National Technical Information Service as PB-206 123, $3.00 in paper copy, $0.95 in microfiche. Water Research Institute Bulletin 3, 1971. 24 p, 3 fig, 7 tab, 31 ref. OWRR A-002-WVA (4).

Descriptors: *Acid mine water, *Sewage, *Yeasts, *Fungi, *Bacteria, Sewage bacteria, Microorganisms, Biochemical oxygen demand, Hydrogen ion concentration, Amino acids, Ammonia.
Identifiers: *Acid-tolerant bacteria, *Acid-tolerant microorganisms, Oxygen utilization, Monongahela River, West Virginia.

Numbers of bacteria, yeasts, and fungi were determined in Monongahela River water over a one-year period. Fluctuation in both pH and numbers occurred. The pH of the plating medium and that of the river-water sample influenced the percentage of bacteria in the total microbial population. Occasionally, a species occurring on a plating medium (pH 4.0) was acid tolerant, but most were aciduric or survived as spores. Bacterial colonies developed in the less acidic zones around both yeasts and fungi. Some isolated bacterial colonies were surrounded by a less acidic zone. Low numbers of yeasts and filamentous fungi were present in near neutral sewage, but when acidified with acid mine water or sulfuric acid and then incubated, the predominating flora changed from bacteria to yeasts and filamentous fungi. Acidification of sewage with acid mine water or sulfuric acid decreased the BOD. Acidification with acid mine water caused the greater decrease. Of the common amino acids, fifteen were detected in raw sewage. Several of these disappeared or were present in trace quantities only when sewage was acidified with acid mine water. Ammonia concentration was greater in sewage and acid mine water mixtures. (Wilson-West Virginia)
W72-03531

EXPERIMENTAL AND THEORETICAL STUDY OF THE HYDRODYNAMICS OF DISPERSION IN RIVERS AND ESTUARIES,
Hydronautics, Inc., Laurel, Md.
Jin Wu.
Available from the National Technical Information Service as PB-200 098, $3.00 in paper copy, $0.95 in microfiche. Final Technical Report 7003, Apr 1971, 49 p, 24 fig, 30 ref. OWRR C-1671 (No. 3155) (1).

Descriptors: *Dispersion, *Hydrodynamics, Velocity, Pipes, Channel morphotogy, Turbulence, *Open channel flow, *Turbulent flow, Water pollution control, Estuaries, Path of pollutants, Storage, Effluent streams, Quality control, Water quality.
Identifiers: *Longitudinal dispersion, *Dispersion coefficient.

The results of longitudinal dispersion of hydrodynamically indisguishable material summarized: (1) A scheme for calculating the dispersion coefficient in the initial stage is suggested and is compared favorably with the experimental results; (2) The longitudinal dispersion was measured with tracer ejected uniformly across the stream or ejected locally at various positions; (3) The results of velocity measurements in rectangular pipes, smooth and rough, from various sources are compiled and analyzed; (4) The effects of channel configuration both transverse and longitudinal variations were studied; (5) The use of a second order tensor to represent the dispersivity in turbulent channel flows is proposed; (6) Studies of turbulent diffusibity in density-stratified flows was reviewed; (7) Temporary storage of pollutant in, and its subsequent slow release from the dead-water or slow-moving zones, are believed to be the major mechanism governing the longitudinal dispersion in natural streams. The methods for calculating the dispersion coefficient are also suggested; (8) The environmental conditions on the longitudinal dispersion has been illustrated mathematically. This effect has hitherto been neglected and is important for conducting field measurements and for choosing pollutant-ejection site. This three-years' research program have provided useful information to hydraulic engineers in predicting the waste carrying capacities of streams and for designing ways and means to control or to improve the rate of waste removal.
W72-03540

CATALOG OF PESTICIDE NMR SPECTRA,
Environmental Protection Agency, Athens, Ga. Southeast Water Lab.
For primary bibliographic entry see Field 05A.
W72-03541

POPULATION, ACTIVITY, AND PRODUCTION OF BACTERIA IN BOTTOM SEDIMENTS OF THE CENTRAL PACIFIC,
Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod.
For primary bibliographic entry see Field 05A.
W72-03547

MISCIBLE DISPLACEMENT OF 2,4-D HERBICIDE DURING CONSTANT LIQUID FLOW VELOCITY INTO INITIALLY DRY SOILS,
Florida Univ., Gainesville. Water Resources Research Center.
V. Jyothi.
Research Report, 1971. 108 p, 21 fig, 9 tab, 94 ref. OWRR-A13-FLA (2).

Descriptors: *2-4-D, *Absorption, Sands, Subsoil, Peat, Soils, Separation techniques, Model studies, Chromatography, Path of pollutants, Pesticides, Mathematical models, Chlorinated hydrocarbon pesticides.
Identifiers: Mass flow, Liquid scintillation, Thin layer chromatography.

The movement of 2,4-D herbicide through glass beads, fine sand, mucky peat, and a subsoil was studied experimentally and the results compared to a mathematical model. In experiments, a lucite column was packed with air-dry porous material and placed vertically in a constant temperature chamber. Herbicide solution was introduced from the bottom of the column at either 50 or 100 ml/hr. Liquid scintillation counting was used to determine herbicide concentrations in the effluent of the column and in soil extracts. Random effluent samples were also analyzed by thin-layer chromatography. From results, it was concluded that 2,4-D, when applied on the soil surface, shows a great deal of mobility in mineral soils. Organic matter in the soil seemed to reduce mobility. In sandy soils, there is apparently danger of the herbicide moving with groundwater and endangering aquatic plants. In organic soils, even large amounts of precipitation cannot carry the herbicide very far down the profile. (Mortland-Battelle)
W72-03563

METABOLIC FATE OF CYSTEINE AND METHIONINE IN RUMEN DIGESTA,
Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia).
C. J. Nader, and D. J. Walker.
Applied Microbiology, Vol 20, No 5, November 1970, p 677-681. 1 tab, 25 ref.

Descriptors: *Metabolism, *Ruminents, Sulphur compounds, Microorganisms, Nutrient requirements, Water pollution effects, *Path of pollutants.
Identifiers: *Cysteine, *Methionine.

Several reports have appeared indicating that inorganic sulfur compounds in the rumen are used in the synthesis of sulfur amino acids and that the pathway involves reduction to sulfide prior to upgrading into the protein of rumen microorganisms. Estimates were obtained of the extent to which cysteine and methionine were incorporated into the protein of the microbes of rumen digesta without prior degradation and resynthesis. By using the amino acids labeled with both 35S and 14C, it was observed that a large proportion of the 35S appeared in the sulfide pool and of the 14C appeared in the volatile fatty acids. By isolating the appropriate amino acid, obtaining the 14C to 35S ratio, and comparing this with the ratio in the added amino acid, the degree of direct incorporation was calculated. For cysteine it was estimated that at most 1% and for methionine, at most 11% of the amino acid in the free pool was incorporated unchanged into microbial protein. As a consequence of these findings, it is considered that the method for measuring microbial protein synthesis in rumen digesta based upon incorporation of 35S from the free sulfide pool is not seriously affected by direct utilization of sulfur amino acids arising from dietary sources. (Goessling-Texas)
W72-03623

MERCURY IN THE ENVIRONMENT.

Environmental Science and Technology, Vol 4, No 11, November 1970, p 890-892. 2 tab.

Descriptors: Water pollution effects, Industries, Rocks, Soils, Fish, Animals, Analytical tests, Sampling, Data collection, Water pollution sources, *Path of pollutants, Monitoring.
Identifiers: *Mercury, Natural sources, *Methyl mercury.

After being present on the earth for 4.5 billion years, mercury is now the center of public attention and concern. Monitoring and analysis throughout the country now show that mercury is present in amounts deemed excessive in all realms of the environment. Another factor to consider is the form of mercury. Methyl mercury and other alkyl forms, primarily the most harmful, are similarly toxic. Phenyl and inorganic mercury are less toxic and less harmful, but when released into water, these forms can be converted into methyl mercury. The ability to convert elemental mercury to methyl mercury is held by various organisms. Mercury is released into the environment by natural evaporation from rocks and by man. Thus if all man generated releases were stopped, only half the problem would be solved. Mercury is used in numerous industries that would collapse if the metal could not be used. Mercury can be measured by several processes and better, cheaper tests are being developed. Industrial plants have reduced discharges of mercury into waterways drastically (86% since the summer of 1968). It has been stated, however, that: 'Mercury is more serious than DDT and less serious than nuclear testing.' There is no reason at this time to declare a public health crisis, but the situation is potentially dangerous and requires study. (Goessling-Texas)
W72-03644

RAPID UPTAKE OF MERCURIC ION BY GOLDFISH,
Cornell Univ., Ithaca, N.Y. Dept. of Entomology.
For primary bibliographic entry see Field 05C.
W72-03646

CONTROL OF POLLUTION FROM OUTBOARD ENGINE EXHAUSTS: A RECONNAISSANCE STUDY.
Alaska State Dept. of Fish and Game, Juneau. Sport Fish Div.

Copy available from GPO Sup Doc as EP2.10:15020 ENN, $0.50; microfiche from NTIS as PB-206 192. Environmental Protection Agency Water Pollution Research Series Report 15020 ENN, September 1971. 38 p, 3 fig, 8 tab, 32 ref. EPA 15020 ENN.

Descriptors: *Recreation wastes, *Boating, *Water pollution sources, Pollutant identification, Water quality, Analytical techniques, Water pollution control, Water sports, Biodegradation.
Identifiers: *Watercraft pollution, *Outboard engine exhaust, Two-cycle engines.

A reconnaissance study has been made to determine the extent of pollution which results from the operation of a two-cycle outboard engine. Comparisons have been made of engine operation with and without a pollution control device attached. Studies have also been made of the biodegradability of the fuel and exhaust products. Tests made in a swimming tank with an untuned engine have shown that the quantity of fuel wasted as exhaust varied from about 7 percent of the volume of fuel used at high speeds, to over 30 percent at low speeds. For a recently tuned engine, the quantity of fuel discharged ranged from about 3 percent at high speeds to about 26 percent at low speeds. When the Goggi pollution control device was installed, these quantities were intercepted and collected rather than discharged with the exhaust. Analysis at various depths indicated that nearly all products separated from the water in a short time and collected on the surface. Very little dissolved or emulsified oil was noted. Various analytical techniques were studied. Both fuel and exhaust products are capable of supporting microbial growth. Growth rates appear to be limited by available oxygen. (EPA abstract)
W72-03783

CONTROL OF MINE DRAINAGE FROM COAL MINE MINERAL WASTES PHASE I - HYDROLOGY AND RELATED EXPERIMENTS,
Truax-Traer Coal Co., Pinckneyville, Ill.
G. L. Barthauer, Z. V. Kosowski, and J. P. Ramsey.
Copy available from GPO Sup Doc as EP2.10:14010 DDH, $1.25; microfiche from NTIS as PB-206 194, $0.95. Environmental Protection Agency, Water Quality Office, Water Pollution Control Research Series, 14010DDH, August 1971. 148 p, 15 fig, 11 tab, 7 ref. Environmental Protection Agency Grant 14010 DDH.

Descriptors: *Mine drainage, *Lagoons, Grasses, Reclamation, *Mine wastes, Waste dumps, *Acid mine water, Coal mine wastes, *Vegetation establishment, Acidic water, Mine acids, Waste water (Pollution).
Identifiers: New Kathleen Mine (Illinois), Slurries.

A project has been underway since 1968, at an abandoned mine located in southern Illinois, attempting to demonstrate practical means of abating pollution from coal mine mineral wastes. The site included a refuse pile occupying approximately 40 acres and a slurry lagoon complex of 50 acre. The project consists of two phases. Phase I, reported herein, describes the characteristics and acid formation rate of the refuse pile. The average rate of acid formation for this refuse pile is 198 pounds of acidity, as CaCO3, per acre per day. Acid contribution from the slurry lagoons was not determined but appears to be negligible. As an abatement measure, a number of experimental vegetative covers were tested. Grass was successfully established with and without the use of topsoil, weathering well for one year. The long-term effects of establishing a grass cover directly on the refuse without the use of topsoil are not known at this time. Phase II, currently in progress, will implement specific remedial procedures for the entire site, to be followed by a monitoring program that will determine the degree of pollution abatement. (EPA abstract)
W72-03785

SYSTEMATIC FOLLOW-UP STUDY OF THE CIRCULATION OF POLIOMYELITIC AND OTHER ENTERIC VIRUSES IN WASTE WATER,
Ustav Epidemiologie a Mikrobiologie, Prague (Czechoslovakia).
N. Vaneckova, J. Koza, and V. Mikesova.
Cesk Epidemiol Mikrobiol Imunol. 20 (1): 18-26. Map. 1971. Russian and English summaries.
Identifiers: Circulation, Coxsackievirus, Echovirus, Enteric, Follow-Up, Myelitic, Polio, Systematic, Viruses, Waste.

Results of an investigation of waste water samples collected from Nov. 1962 to Oct. 1966 are presented. In 10 selected regions, 229 samples were collected from which 96 strains were isolated, including 44 poliomyelitic, 20 ECHO and 8 Coxsackie strains; 24 strains remained untypable. Wild poliovirus strains were seen in waste water of 2 regions.--Copyright 1971, Biological Abstracts, Inc.
W72-03812

ENVIRONMENTAL CONTAMINATION BY MERCURY (HG SERIES NO. 12): I. INORGANIC AND METHYLMERCURY IN THE WASTE OF CHEMICAL FACTORIES AND RESULTING WATER POLLUTION,
Tokyo Dental Coll. (Japan).
Hiroshi Aoki.
Jap J Hyg. 24 (5/6): 536-545. Illus. 1970. In Japanese with English summary.
Identifiers: Chemical, Contamination, Environmental, Factories, Inorganic, Japan, Mercury, Methyl, Pollution, Waste.

Industrial waste disposal was examined and the total mercury (Hg) and methylmercury concentration was determined. In an aldehyde factory, acetaldehyde synthesis from acetylene using an Hg catalyst produced 0.10-0.93 ppm of methylmercury in wash water. After effective disposal, methylmercury was no longer detected in the final waste water remains. In a soda factory, total Hg contained in waste water was 1/10 that of the aldehyde factory, with no methylmercury detectable, the sludge (brine mud) precipitated and filtered from the circulating brine of a brine factory contained 40-200 ppm of total Hg and around 0.001 ppm of methylmercury. In vinyl chloride monomer synthesis from acetylene, 0.01-0.11 ppm of total Hg was found in alkaline wash water from the reaction tower, of which 0.001 ppm was detected as methylmercury. In each factory, the final waste water flowing into the river contained less than 0.01 ppm of Hg with no detectable methylmercury at the time of survey in 1966-68. Checking concentration alone is not reliable, as the reduction of Hg concentration by dilution in non-contaminated water may occur. Thus, the total quantity of Hg flowing into the river per day or per mo. is the key point for surveillance.--Copyright 1971, Biological Abstracts, Inc.
W72-03814

A RAPID TECHNIQUE FOR LOCALIZING POLLUTION IN SEA AND BRACKISH WATERS (THE CONTINUOUS DETERMINATION OF DISSOLVED OXYGEN),
C. Armangau, and A. Caumette.
Sci Peche. 183: 11-18. Illus. 1969.
Identifiers: Brackish, Detection, Determination, Dissolved, Localizing, Oxygen, Pollution, Rapid, Sea, Technique.

This technique is a rapid means for detecting polluted zones. Accidents caused by a share drop in O2 level may be presented and important information about the development of O2 levels as a func-

tion of time may be obtained. It enables a better understanding of life conditions in the waters and thus will help to prevent their complete depopulation in certain summers.--Copyright 1971, Biological Abstracts, Inc.
W72-03817

STUDIES ON THE ARTIFICIAL RADIOACTIVITY OF FISH IN 1967 AND 1968,
Rostock Univ. (East Germany). Institut fuer Hygiene.
F. Randow, and H. A. Schulze.
Nahrung. 15 (1): 81-89. 1971. English and Russian summaries.
Identifiers: Abramis-Brama, Artificial, Bream, Esox-Lucius, Fish, Food, Human, Pike, Radioactivity.

In 1967-1968, 90Sr, 137Cs and total beta-activity were measured in the flesh of fresh-water fish from lakes in the N districts of the German Democratic Republic (Mecklenburg) and of salt-water fish from the Baltic and the North Atlantic. Total beta-activity of the samples amounted to 2100-3100 pCi/kg. Radioanalysis revealed the following mean contaminations: bream (Abramis brama), 6 pCi90Sr/kg and 332 pCi137Cs/kg; pike (Esox lucius), 2 pCi90Sr/kg and 450 pCi137Cs/kg. Salt-water fish contained 1-7 pCi90Sr/kg and 120 pCi137Cs/kg (Baltic) or 24 pCi137Cs/kg (North Atlantic). The 90Sr content of the bones varied between 1.0-2.0 pCi/g Ca (fish from the Baltic) and 4.0-6.4 pCi/g Ca (fresh-water fish). By way of fish consumption, the population of the northern districts ingests 22 pCi90Sr and 1120 pCi136Cs/capita/yr, which is nearly 0.1% of the maximum allowance of yearly activity uptake.--Copyright 1971, Biological Abstracts, Inc.
W72-03818

OCCURRENCE AND PERSISTENCE OF PICLORAM IN GRASSLAND WATER SOURCES,
Texas A and M Univ., College Station. Dept of Range Science.
R. H. Haas, C. J. Scifres, M. G. Merkle, R. R. Hahn, and G. O. Hoffman.
Weed Res. 11 (1): 54-62. Illus. 1971. French and German summaries.
Identifiers: Chromatography, Gas, Grassland, Herbicide, Picloram, Rainfall, Runoff, Water.

At 2 wk following application, concentrations of picloram in surface runoff water collected adjacent to a South Texas grassland treated with 1.1 kg/ha ranged from 0.055 to 0.184 ppm as detected by gas chromatography. Picloram in surface runoff water diminished with time and amount of rainfall as a decay function. Picloram was not detectable in a flowing stream 0.8 km below a 32-ha area treated with 1.1 kg/ha. Residual picloram was not detected in domestic water wells at any time up to 2 yr following treatment of adjacent areas with 1.1 kg/ha. Dissipation of picloram from treated livestock-watering ponds was concentration-dependent, with the final losses resulting largely from dilution. Initial loss rates in the ponds ranged from 14 to 18%/day but decreased to less than 1%/day at 100 days following treatment. After 100 days, when the concentrations were less than 0.005 ppm, the primary changes in picloram content appeared to be due to dilution from rainfall or to concentration by runoff from adjacent treated areas.--Copyright 1971, Biological Abstracts, Inc.
W72-03819

THE MOBILITY OF PHOSPHORUS, POTASSIUM, AND CALCIUM IN A FOREST SOIL,
Washington Univ., Seattle. Coll. of Forest Resources.
Hans Riekerk.
Soil Sci Soc Amer Proc. 35 (2): 350-356. Illus. 1971.
Identifiers:alcium, Forest, Leachates, Mobility, Movement, Nutrition, Phosphorus, Potassium, Pseudotsuga-Menziesii, -G, Radio, Rain, Soil, Tracers.

A study was made to evaluate the movement of nutrient elements in rainwater percolating through a well-drained Douglas-fir (Pseudotsuga Menziesii (Mirb.) Franco) forest soil. Radiotracers of P, K, and Ca mixed with stable elements, were applied to the forest floor simulating rainwash input, Leachates from tension lysimeters were collected periodically and analyzed for nutrient and tracer contents. Trees and soil were sampled and analyzed at the end of the experimental period. The data showed large coefficients of variation typical of biological materials. Twenty percent of the labeled P leached through the forest floor during the yr, representing 10% of the total P movement with rain water. Similarly, 8% of labeled K, representing 27% of leached K, and 2% of labeled Ca, representing 5% of leached Ca, moved annually with rain water through the forest floor. Comparable leaching values through the top 20 cm of mineral soil were a thousand times less, but with most of Ca and least of P released. These data were related to forest soil contents and indicated the elemental mobility to be dependent on the physico-chemical properties of the forest soil, as well as the ionic properties and biological functions of the nutrient elements.--Copyright 1971, Biological Abstracts, Inc.
W72-03825

MONITORING WATER POLLUTION BY REMOTE SENSING,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
For primary bibliographic entry see Field 07B.
W72-03862

AERIAL PHOTOGRAPHY FOR WATER RESOURCES STUDIES,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
For primary bibliographic entry see Field 07B.
W72-03863

A STATISTICALLY BASED MATHEMATICAL WATER QUALITY MODEL FOR A NON-ESTUARINE RIVER SYSTEM,
Stevens Inst. of Tech., Hoboken, N. J. Dept. of Economics of Engineering and Management Science.
M. A. Tirabassi.
Water Resources Bulletin, Vol 7, No 6, p 1221-1237, December 1971. 7 fig, 6 tab, 18 ref.

Descriptors: *Water quality, *Path of pollutants, *Statistical models, Mathematical models, Simulation analysis, Statistics, Statistical methods, Rivers.

A mathematical model has been formulated through the use of the mathematical statistics, for the purpose of predicting river water quality without reference to the causal chemical, biological and physical relationships. This is a 'black box' approach wherein with a known input, one may reliably predict the output. The use of a statistical method for predicting river-water quality can provide accurate predictive information with a minimum of time and money expended if a sufficiently large data base is available for the river system in question. The formulation procedure, data collection requirements, model hypothesis testing and significance procedures, and finally validation methods employed in verifying the final model equations are given. (Knapp-USGS)
W72-03877

QUAL 1 - SIMULATION OF WATER QUALITY IN STREAMS AND CANALS - PROGRAM DOCUMENTATION AND USERS MANUAL.
Texas Water Development Board, Austin. Systems Engineering Div.

Available from NTIS as PB-202 973, $3.00 in paper copy, $0.95 microfiche. Texas Water Development Board Final Report (EPA-OWP-TEX-QUAL 1), September 1970. 79 p, 8 fig.

Descriptors: *Water quality, *Streams, *Canals, *Mathematical models, Forecasting, Water temperature, Biochemical oxygen demand, Dissolved oxygen, Equations, Advection, Diffusion, Input-output analysis, System analysis, Computer programs.

A mathematical model is described for use in simulating water quality behavior of streams and canals. The spatial and temporal variations of temperature, biochemical oxygen demand, dissolved oxygen, and conservative minerals can be predicted on an hourly basis utilizing the one-dimensional form of the advection-diffusion transport equation. Instructions are provided for program usage, imput-output descriptions, program description and listing, variable name definitions, and flow charts of program logic. (Woodard-USGS)
W72-03880

BIOCHEMICAL OXYGEN DEMAND IN THE DNIEPER-BUG ESTUARINE AREA (BIOKHIMICHESKOYE POTREBLENIYE KISLORODA V DNEPRO-BUGSKOY UST-'YEVOY OBLASTI),
State Oceanographic Inst., Moscow (USSR).
Ye. P.Kirillova.
In: Gidrologiya i Gidrokhimiya morey i ust'yev rek; Gosudarstvennyy Okeanograficheskiy Institut Trudy, No 98, p 222-229, 1970. 2 fig, 3 tab, 12 ref.

Descriptors: *Biochemical oxygen demand, *Water properties, *Water pollution, Waste water (Pollution), Sewage, Organic matter, Oxidation, Dissolved oxygen, Aquatic environment, Aquatic microorganisms, Phytoplankton, On-site investigations.
Identifiers: *USSR, Dnieper River, Bug River, Oxidizability.

On-site investigations were conducted in 1965-67 in the Dnieper-Bug estuarine area to determine the amount of dissolved oxygen removed from the aquatic environment during the biochemical oxidation of organic matter by aquatic microorganisms. The biochemical oxygen demand values, reported as 5-day, 20C, BOD, range from 0.93 to 13.08 mg/liter. The estuarine area is regionalized on the basis of the 5-day BOD determinations and the constants of the consumption rate. Higher 5-day BOD values, related to the surface waters of middle and lower reaches of the estuary, are determined by the inflow of organic substances of allochthomous and planktonic origin, respectively. The boundaries between the upper and middle reaches vary slightly and are expressed more or less clearly. During the growing period of phytoplankton the boundaries between the middle and lower reaches are missing. The stability of organic matter is described in terms of the ratio of 5-day BOD to permanganate oxidizability. (Josefson-USGS)
W72-03895

CHEMICAL POLLUTION OF THE COASTAL WATERS OF SEAS OF THE USSR (KHIMICHESKOYE ZAGRYAZNENIYE PRIBREZHNYKH VOD MOREY SSSR),
State Oceanographic Inst., Moscow (USSR).
A. I. Simonov, A. S. Pakhomova, A. K. Velichkevich, and N. A. Afanas'yeva.
In: Gidrologiya i gidrokhimiya morey i ust'yev rek; Gosudarstvennyy Okeanograficheskiy Institut Trudy, No 98, p 212-221, 1970. 3 fig, 3 tab, 12 ref.

Descriptors: *Water pollution sources, *Pollutants, *Wastes, *Waste water (Pollution), Waste water disposal, Sewage, Chemical wastes, Industrial wastes, Oil wastes, Organic wastes, Domestic wastes, Oil, Phenols, Organic compounds, Heavy metals, Acids, Chemical analysis, Biochemical oxygen demand, Sea water, Bottom sediments.
Identifiers: *USSR, Black Sea, Sea of Azov, Caspian Sea, Baltic Sea, Barents Sea, White Sea, Chemical pollution, Oxidizability.

Because of the development of industry and the growth of cities and populated areas, sea basins have become catastrophically polluted by domestic and industrial waste waters, particularly in coastal zones. Investigations conducted in 1964-65 by local administrations of the USSR Hydrometeorological Service under the scientific direction of the State Oceanographic Institute have revealed extensive pollution of coastal waters in many regions of the Black Sea, the Sea of Azov, the Caspian, Baltic, White, Barents, and other seas. Health resort areas and regions vital to the fishing industry in the vicinity of the Black Sea, the Sea of Azov, and the Caspian and Baltic Seas are especially threatened. The main source of pollution is waste water disposal in the sea. Almost none of the industrial and domestic waste discharged along populated coasts is treated. The most dangerous substances are introduced by the chemical, cellulose-paper, petroleum refining, metallurgical, food, and some light industries. The main pollutants in these waters are petroleum products, oils, phenols and other organic compounds, acids, and heavy metals. The concentration of harmful substances in the water and bottom deposits is progressively increasing, sanitary conditions are deteriorating, and the biological productivity of the seas is decreasing. Pollution is extending far beyond the limits of coastal zones into areas of the open sea. Antipollution procedures are needed to drastically curtail the discharge of waste waters and to provide for their preliminary treatment. (Josefson-USGS)
W72-03902

A COMPREHENSIVE STUDY OF SAN FRANCISCO BAY, VOLUME VIII, SUMMARY AND RECOMMENDATIONS,
California Univ., Berkeley. Sanitary Engineering Research Lab.
For primary bibliographic entry see Field 05A.
W72-03958

MERCURY IN WASHINGTON STATE,
Washington State Dept. of Ecology, Olympia. Office of Technical Services.
Ronald A. Lee.
January 1971. 22 p, 9 tab.

Descriptors: *Waste water (Pollution), *Water analysis, *Heavy metals, *Water pollution sources, *Washington, Ecology, Fish conservation, Pulp wastes, Municipal wastes, Waste identification, Industrial wastes.
Identifiers: *Mercury, *Mercury detection, Chlorine plant discharges, Coal combustion releases.

Mercury levels in selected industrial and municipal wastewaters and from environmental sources are presented. The results contain a listing of data collected to determine the occurrences and distribution of mercury in Washington State, in accordance with State regulation and control of unnatural mercury discharges. The amount of mercury lost to waterways in each of two mercury cell chlorine-alkaline plants exhibited a dramatic decrease between April and December, 1970. Sediment samples from Bellingham Bay in an area immediately adjacent to the chlorine-alkaline plant outfall contained high mercury levels when compared to samples taken in other areas of the bay. In general, pulp and paper mill wastewater samples contained very low levels of mercury, usually less than 1 microgram/l. The Georgia-Pacific pulp mill complex at Bellingham and the Weyerhaeuser mill at Longview used caustic from the mercury cell process and therefore were sampled on several occasions. Very rarely did mercury levels exceed 5 microgram/l in the discharges from these two pulp mills. An area of concern not yet fully defined is the loss of mercury to the air through combustion of several million tons of coal per year at the fossil-fuel power generating plant under construction near Centralia, Lewis County, Washington. Background mercury levels in Hanaford Creek and some of its tributaries at this site are presently being monitored to establish a reference baseline. Mercury residues from various fish and shellfish tissue samples were consistently below the 0.5 ppm guideline set by the Food and Drug Administration as an action level. (Poertner)
W72-03974

INORGANIC FERTILIZER AND PHOSPHATE MINING INDUSTRIES - WATER POLLUTION AND CONTROL.
Battelle Memorial Inst., Richland, Wash.

Copy available from GPO Sup Doc $1.75; microfiche from NTIS as PB-206 154, $0.95. Environmental Protection Agency Water Pollution Control, Research Series No 12020 FPD, September 1971, 225 p, 48 fig, 23 tab, 88 ref. EPA Grant No. 12020 FPD.

Descriptors: *Fertilizers, *Industrial production, *Industrial waste, Waste water disposal, Waste water treatment, Water pollution control, Costs, Nitrogen compounds, Phosphates, Surveys, Mining, Mine wastes.
Identifiers: *Fertilizer production, *Phosphate rock production.

A state-of-the-art survey was made of the water pollution problems which result from the production of inorganic fertilizers and phosphate rock. Information required to complete the study was obtained through an extensive literature search, questionnaires sent to the major fertilizer producers, and visits to selected production plants. Ninety eight plants representing thirty three different companies were surveyed. Production figures since 1940 and estimates of production through 1980 were accumulated for phosphate rock and the major fertilizer products. The specific production operations which are the principal generators of contaminated waste waters were identified, and the waste water volumes and compositions for each operation were determined wherever possible. The capability of current technology to treat and control the contaminated waste waters generated by the fertilizer industry was evaluated. Problem areas where additional research and development effort is needed to provide adequate control of waste water discharge were identified. (EPA abstract)
W72-03983

A PROPOSAL TO DEVELOP A PLAN FOR THE CONSTRUCTION AND TESTING OF WATER POLLUTION FORECASTING MODELS,
Missouri Univ., Columbia. Dept. of Industrial Engineering.
G. S. Staats, L. G. David, O. W. Miller, H. A. Knappenberger, and K. C. Cooper.
Missouri Water Resources Research Center, Completion Report, October 1, 1971. 42 p, 5 fig, 7 tab, 3 ref, 2 append. OWRR A-040-MO (1).

Descriptors: *Water pollution sources, *Water quality, Streamflow, *Forecasting, *Correlation analysis, *Model studies, Missouri, Dissolved oxygen, Phosphates, Coliforms.
Identifiers: Cuivre River basin (Mo).

The problem of water pollution control requires that a study be made to determine the extent of efforts being presently expended to measure water quality and to evaluate the effectiveness of existing data as a predictor of the level of stream pollution. Data pertaining to water quality in the river basins in Missouri are being obtained by a state and a federal agency. This study summarizes the data being obtained and presents the results of an initial investigation of the correlations among four variables: rate of stream flow, dissolved oxygen, total phosphate and total coliform bacteria. Total coliform bacteria correlated very highly with the rate of stream flow. A step-by-step procedure is proposed for developing and evaluating a comprehensive forecasting model to determine the significant variables that would be effective in forecasting the degree of pollutant concentration in streams.
W72-03986

QUALITY OF STORMWATER DRAINAGE FROM URBAN LAND,
Rex Chainbelt, Inc., Milwaukee, Wis. Ecology Div.
E. H. Bryan.
Paper presented at the Seventh American Water Resources Conference, October 28, 1971, Washington, D.C. 11 p, 1 fig, 7 tab, 12 ref. OWRR A-034-NC (3).

Descriptors: *Water pollution sources, *Urbanization, *Storm runoff, *Pollutant identification, *North Carolina, Cities, Organic matter, Pesticides, Solid wastes, Dissolved solids, Phosphates, Chlorides, Data collections, Chemical analysis, Surface waters.
Identifiers: *Urban hydrology, *Durham (NC).

Urban stormwater (from a 1,067-acre drainage basin in Durham, N.C. with a population density of 9 persons per acre) produced an annual BOD load approximately equal to the contribution of its secondary wastewater treatment plant effluent. Total organic matter (COD) exceeded the amount in raw sanitary sewage from a residential area of the same size. Mean basin yields (lb/acre/day) were: BOD 0.23, COD 2.85, Total Solids 43.6, Volatile Total Solids 4.8, Total Phosphate 0.01 and Chloride 0.20 (as NaCl). The yield of lead presumed to originate from internal combustion engines operating on and near the basin was 0.006 lb/acre/day. The concentration of total pesticides (Dieldrin; p, p'DDE; o,p-DDT; p,p'DDD and p,p'DDT) weighted for flow significance was estimated to be 1.2 parts per billion. The major long-term pollutional impact on a projected downstream reservoir was considered to be the fixed solids residue and long-term oxygen demand (COD). (Woodard-USGS)
W72-03995

DEVELOPMENT OF A SIMULATION MODEL FOR STORMWATER MANAGEMENT,
Metcalf and Eddy, Inc., Palo Alto, Calif.
J. A. Lager, R. P. Shubinski, and L. W. Russell.
Journal of Water Pollution Control Federation, Vol 43, No 12, p 2424-2435, December 1971. 9 fig, 1 tab, 4 ref. FWQA-14-12-501, -502, and -503.

Descriptors: *Simulation analysis, *Urbanization, *Storm runoff, *Rainfall-runoff relationships, *Computer programs, Sewers, Storm drains, Water yield, Hydrographs, Water quality, Water pollution sources, Mathematical models.
Identifiers: *Urban hydrology.

A comprehensive simulation model is capable of representing urban stormwater runoff phenomena in quality and quantity. Hydrographs and pollutographs (time varying quality concentration or mass values) were generated from points of origin in real time sequence to points of disposal with user options for intermediate storage and/or treatment facilities. Incorporated dry-weather flow routines permit the evaluation of both combined and separate sewerage systems. Internal cost routines and receiving water quality assisted in the direct cost benefit analysis of alternate programs of water quality enhancement. (Knapp-USGS)
W72-04022

ULTRAMICRO ANALYSIS OF EXPLOSIVES IN SEA WATER,
Naval Ordnance Lab., Silver Spring, Md.
For primary bibliographic entry see Field 05A.
W72-04037

DOSAG-I, SIMULATION OF WATER QUALITY IN STREAMS AND CANALS. PROGRAM DOCUMENTATION AND USERS MANUAL.
Texas Water Development Board, Austin. Systems Engineering Div.

Available from NTIS, Springfield, Va 22151 as PB-202 974, $3.00 in paper copy; $0.95 in microfiche. Texas Water Development Board Report EPA-OWP-TEX-DOSAG-1, September 1970. 51 p, 7 fig, 3 tab, 7 ref.

Descriptors: *Water quality, *Streams, *Mathematical models, *Dissolved oxygen, *Forecasting, Computer programs, Input-output analysis, Streamflow, Flow rates, Systems analysis, Methodology.
Identifiers: *Water quality predictions.

A mathematical model was developed to calculate the biochemical oxygen demand and the minimum dissolved oxygen concentration in a particular stream system. The minimum dissolved oxygen concentration in the stream system may be checked against a prespecified target level dissolved oxygen concentration. If the minimum dissolved oxygen level is below the target dissolved oxygen level, the program will compute the required amount of flow augmentation to bring the dissolved oxygen level up to the target level in the entire system. The user of the program specifies the locations within the stream system at which dilution water is available for flow augmentation. The program is designed to be run for varying climatic and hydrologic conditions during a 12-month period. Thus, it is possible to enter up to 12 different temperatures and corresponding discharges to each of the headwaters within the stream system being modeled. This model (DOSAG-I) is quite flexible and can be adapted to any stream system. One major restriction is that large impoundments such as reservoirs cannot be considered by this program. (Woodard-USGS)
W72-04047

VOLATILE ACID PRODUCTION BY CLOSTRIDIUM BOTULINUM TYPE F,
National Communicable Disease Center, Atlanta, Ga.
C. W. Moss, R. T. Howell, D. C. Farshy, V. R. Dowell, and J. B. Brooks.
Canadian Journal of Microbiology, Vol 15, 1970, p 421-425. 1 fig, 2 tab, 17 ref.

Descriptors: *Clostridium, *Pathogenic bacteria, Laboratory tests, Gas chromatography, Pollutant identification, Water pollution sources, *Bacteria.
Identifiers: *Volatile fatty acids, Proteolytic strains, Non-proteolytic strains.

Recent studies have shown that Clostridium botulinum type F is widely distributed in nature. Since the original isolation from liver paste in the Danish Island of Langeland, it has been recovered from various marine sources and from soil in Argentina. Both proteolytic and non-proteolytic strains have been observed. Recently, gas-liquid chromatography (g.l.c.) has yielded impressive amounts of new data on the clostridia. Several workers have determined the volatile fatty acid pattern of various Clostridium species; however, only a limited number of strains of each species were examined. A study has been concluded in which the volatile fatty acid production of 10 isolates of C. botulinum type F has been analyzed by g.l.c. The proteolytic activity and volatile fatty acid production of 10 isolates of Clostridium botulinum type F from diverse geographical locations were determined. Two of the 10 strains were non-proteolytic, 3 were slightly proteolytic, and 5 were strongly proteolytic. The non-proteolytic cultures and the slightly proteolytic cultures produced acetic and butyric acid. The strongly proteolytic cultures produced mainly acetic, butyric, isobutyric, and isovaleric acid, and small to trace amounts of propionic, isocaproic, and caproic acid. The relative amounts of the various acids produced were markedly influenced by the growth medium. The addition of glucose to the growth medium caused an increase in the relative amount of butyric acid and a decrease in isobutyric and isovaleric acid. (Goessling-Texas)
W72-04060

OIL AND GAS WELLS-POTENTIAL POLLUTERS OF THE ENVIRONMENT,
Bureau of Mines, Bartlesville, Okla. Bartlesville Petroleum Research Center.
A. G. Collins.
Journal Water Pollution Control Federation, Vol 43, No 12, December 1971, p 2383-2393, 3 fig, 3 tab, 34 ref.

Descriptors: Water pollution sources, *Oil wells, *Drilling, Drilling fluids, Mud, Brines, Chemicals, Subsurface water, Surface runoff, Waste water disposal, Deep wells, Lagoons.

No detailed studies have been made of the ways in which drilling fluids, drilling muds, well cuttings and well treatment chemicals may contribute to pollution. The possibilities and mechanisms by which these substances can contaminate ground or surface water are discussed in detail. The mechanisms by which the brines, crude oil or gas may infiltrate and pollute ground water are shown. The chemicals used in the well drilling operation are enumerated and some of the ecological implications presented. Current disposal techniques are discussed and the pollution potential is pointed out. The conclusions of this review of the pollution potential of oil and gas well drilling are: (1) the amount of pollution resulting from this sort of operation needs evaluation; (2) improved methods are needed to abate or prevent pollution from this source; (3) permanent disposal techniques are required for the residues of well drilling; (4) geochemical research is needed to determine what happens within a salaquifer used for disposal and what happens to related salaquifers; and (5) sedimentary basins contain saline waters that are enriched in valuable elements, the recovery of which may offset the cost of disposal. (Goessling-Texas)
W72-04069

5C. Effects of Pollution

INDUSTRIAL, DOMESTIC, AND RIVER BIOCHEMICAL OXYGEN DEMAND LOADING SOURCES IN GRAYS HARBOR,
Washington State Dept. of Ecology, Olympia.
Merley F. McCall.
Washington Department of Fisheries, Grays Harbor Cooperative Water Quality Study 1964-1966, Technical Report 7, April 1971, p 100-111. 1 fig, 6 tab, 9 ref.

Descriptors: *Water pollution sources, *Biochemical oxygen demand, *Surveys, *Effluents, *Pulp wastes, *Organic wastes, Water pollution control, Dissolved oxygen, Waste assimilative capacity, Washington, Water quality, Industrial wastes, Sewage effluents, Pulp and paper industry, Waste water disposal.
Identifiers: *Grays Harbor Washington, *Seafood processing wastes.

An estimation was made of the Biochemical Oxygen Demand (BOD) loading being discharged to the Grays Harbor, Washington estuary. All known wastes were quantitated by specific surveys or by a review of the operational records of the industry. The sources inventoried included wastes from three pulp and paper mills, a lumber company, five plywood mills, six fish companies, three domestic sewage facilities and the contribution of four major river systems emptying into the harbor. An average of approximately 500,000 pounds per day of BOD is being discharged into Grays Harbor. Over 90% of this total is contributed by the pulp and paper industry, 5% by the four rivers flowing into the harbor, and less that 1% by the remaining waste sources. (LeGore-Washington)
W72-03520

ENVIRONMENTAL EXPERIENCE WITH RADIOACTIVE EFFLUENTS FROM OPERATING NUCLEAR POWER PLANTS,
Environmental Protection Agency, Cincinnati, Ohio.
For primary bibliographic entry see Field 05B.
W72-03524

CHRONIC EFFECTS OF LOW DISSOLVED OXYGEN CONCENTRATIONS ON THE FATHEAD MINNOW (PIMEPHALES PROMELAS),
Environmental Protection Agency, Duluth, Minn. National Water Quality Lab.

Journal of the Fisheries Research Board of Canada Vol 28, p 1119-1123, 1971, 1 fig, 3 tab, 9 ref.

Descriptors: *Fish, *Dissolved oxygen, *Fish reproduction, *Life cycles, *Bioassay, *Water pollution effects, Minnows, Impaired water quality, *Toxicity, Juvenile fishes.

Fathead minnows were exposed to constant dissolved oxygen concentrations (1.0-5.0) mg/liter for 11 months. The number of eggs produced per female was reduced at 2.0 mg/liter; no spawning occurred at 1.0 mg/liter. Fry growth was reduced significantly at all concentrations below the control (7.9 mg/liter). Fry survival was reduced at 4.0 mg/liter and lower dissolved oxygen concentrations; 18% of the survivors at 4.0 mg/liter were deformed. The time required for hatching was increased at successively lower oxygen concentrations by as much as 50% from 5.0 under control conditions to 7.8 days at 2.0 mg./liter, but no effect on percentage hatch was observed. (EPA abstract)
W72-03525

EFFECT OF HIGH WINTER WATER TEMPERATURES ON ADULT EMERGENCE OF AQUATIC INSECTS,
Environmental Protection Agency, Duluth, Minn. National Water Quality Lab.
Alan V. Nebeker.
Water Research Vol 5, p 777-783, 1971, 5 fig, 13 ref.

Descriptors: *Temperature, Aquatic insects, Stoneflies, Mayflies, Caddisflies, Diptera, Larvae.
Identifiers: *Emergence.

The larvae of 10 species of aquatic insects (Trichoptera, Plecoptera, Ephemeroptera, and Diptera) were subjected to unreasonable high winter water temperatures in the laboratory from November to July. The stonefly (Pteronarcys dosata) and the burrowing mayfly (Hexagenia limbata) emerged in January, 5 months earlier than their natural June emergence time. All other test species exhibited similar premature emergence under test conditions. The time between emergence of males and females was increased by increased water temperatures. (EPA Abstract)
W72-03526

MULTIPLICATION OF CLOSTRIDIUM BOTULINUM TYPE E IN THE GREAT LAKES - CASE STUDY OF GREEN BAY, WISCONSIN,
Wisconsin Univ., Madison. Water Resources Center.
H. Sugiyama.
Available from the National Technical Information Service as PB-206 122, $3.00 in paper copy, $0.95 in microfiche. Technical Completion Report, 1971. 22 p, 5 tab, 16 ref. OWRR A-026-WIS (1), 14-01-0001-3050, 14-01-0001-3250.

Descriptors: *Ecology, *Aquatic plants, *Bacteria, *Toxins, *Invertebrates, Shores, Freezing, Fish, Lakes, Wisconsin.
Identifiers: *Clostridium botulinum type E, *Food poisoning, Green Bay (Wis).

Green Bay was taken as the model to study the source of Clostridium botulinum type E which contaminates fish of the Great Lakes to create a botulism hazard. Certain bottom deposits held in the laboratory after a freeze-thaw treatment supported the growth of type E (50 or more fold increase in most probable numbers). Without the freeze treatment the specimens did not support growth. Productive samples always contained vegetation and were those collected during the warm months. When placed in columns to obtain

depth, artificially induced anaerobic conditions were not needed. Emphasis is placed on the similarity of the type E data to the ecology of C. botulinum type C, the cause of western duck sickness. The primary substrates in which type E multiplies is believed to be the macro-invertebrates associated with the aquatic vegetation that grow in the shallow shore line of Green Bay. Laboratory data are interpreted in terms of the situation that could occur in nature.
W72-03528

STREAM FAUNAL RECOVERY AFTER MANGANESE STRIP MINE RECLAMATION,
Virginia State Cooperative Fishery Unit, Blacksburg.
Kenneth B. Cumming, and Donley M. Hill.
Available from GPO as EP2.10:18050D0H06/71 NTIS $0.95 in microfiche. Environmental Protection Agency, Water Pollution Control Research Series, 18050 DOH, June 1971. 36 p, 16 fig, 14 ref. EPA program 18050 DOH.

Descriptors: *Reclamation, *Aquatic animals, *Water pollution effects, *Strip mines, Manganese, Streams, Fish, Turbidity, Mine wastes, Benthic fauna, Silting, Heavy metals, Water pollution control, Toxicity, Particle size, Suspended load, Virginia.
Identifiers: *Biological community recovery, South Fork Holston River (Va), Slemp Creek (Va).

Chemical, physical and biological monitoring amd assessing stream faunal population differences evaluated manganese strip mine reclamation effects on faunal recovery. Toxicity studies, to determine whether silt and manganese levels were sufficiently high to limit fish survival, rule out the possibility that incident levels of manganese can be acutely toxic to the resident fish species. Faunal communities in streams draining partially reclaimed and unreclaimed areas remain chronically suppressed. Streams draining reclaimed areas support more dense and diverse faunal communities, evidently due to lower turbidity and siltation levels. Rainbow trout showed a statistically slower growth rate in turbid than in clear water, indicating possible chronic exposure to high silt levels. Unreclaimed and partially reclaimed streams have a higher percentage of particles less than 0.841 millimeters in diameter than reclaimed and unaffected streams. Although all bottom fauna taxa seem to be affected equally by high turbidities and siltation in unreclaimed and partially-reclaimed streams, the overall diversity is reduced because of the scarcity of certain orders. Faunal recovery in the reclaimed stream was complete six years after reclamation. Partial reclamation is ineffective for faunal recovery or changing turbidity and silt load. (Jones-Wisconsin)
W72-03530

INFLUENCE OF ACID MINE WATER ON THE MICROFLORA OF SEWAGE,
West Virginia Univ., Morgantown. Water Research Inst.
For primary bibliographic entry see Field 05B.
W72-03531

EFFECTS OF POLLUTION, ESPECIALLY FROM FEEDLOTS, ON FISHES IN THE UPPER NEOSHO RIVER BASIN,
Kansas State Univ., Manhattan. Water Resources Research Inst.
F. B. Cross, and L. M. Cavin.
Available from the National Technical Information Service as PB-206 125, $3.00 in paper copy, $0.95 in microfiche. Completion Report 1971; 50 p, 6 fig, 7 tab, 16 ref. OWRR A-026-KAN (1).

Descriptors: *Fishkill, *Water pollution effects, Sampling, Habitats.
Identifiers: *Feedlot pollution, *Upper Neosho River Basin, Nocomis asper, Notropis rubellus, Noturus nocturnus, Notorus placidus, Notropis lutrensis, Notropis camurus.

In spring, summer, and early autumn, 1969 and 1970, a total of 49 collections of fish were made at 17 localities in the upper Neosho River Basin: Fifty-three species were recorded, approximately as many as were known from the same area prior to severe drought in the early 1950's, establishment of three mainstream impoundments in the 1960's, and severe pollution from feedlots in 1966-67. Species lists were not identical to those obtained in similar but less intensive surveys in 1952 and 1967. Changes in species composition are attributable partly to effects of impoundment (including introductions of some species) and partly to organic enrichment. Diversity indices are being determined for each collection, allowing comparisons among samples from the same site on different dates, between years, and among localities throughout the area. Three species known to have occupied these streams in the 1950's were not found in 1969 or 1970: the recently-described redspot chub, Nocomis asper, Lachner and Jenkins, 1971; the rosyface shiner, Notropis rubellus; and the freckled madtom, Noturus nocturnus. Several additional species were found only rarely in 1969-70, including the Neosho madtom, Noturus placidus, the only species endemic to the Neosho basin. These four and others affected adversely are characteristic of clear, well-oxygenated streams having clean gravel riffles; their depletion is most logically attributable to effects of pollution. The two species selected for detailed study, with respect to differential trends in their populations associated with the period of organic pollution, were the red shiner, Notropis lutrensis, and the bluntface shiner, Notropis camurus. The red shiner became more abundant and more widespread within the streams studied, following fish-kills in 1966-67. Its increase seemingly occurred at the expense of the bluntface shiner, its nearest relative in the Neosho fauna. Apart from the advantage of comparing closely-related species, the bluntface shiner was chosen as the 'pollution intolerant' form because other species fitting that description were not obtained in numbers adequate for the kinds of comparisons desired. The comparative study involved habitats occupied and relative abundance; population structure and growth rates; reproductive requirements, fecundity, and spawning period; and response to reduced oxygen concentrations (routine metabolism, behavior under oxygen stress, loss of equilibrium, and capacity for recovery from temporary stress).
W72-03533

QUALITATIVE COMPOSITION OF PHYTOPLANKTON IN THE VICINITY OF NEWFOUNDLAND,
All-Union Research Inst. of Marine Fisheries and Oceanography, Moscow (USSR).
For primary bibliographic entry see Field 05A.
W72-03543

PHYTOPLANKTON KINETICS IN A SUBTROPICAL ESTUARY: EUTROPHICATION,
Hawaii Inst. of Marine Biology, Kaneohe.
J. Caperon, S. A. Cattell, and G. Krasnick.
Limnology and Oceanography, Vol. 16, No. 4, p 599-607, July 1971. 6 fig, 4 tab, 20 ref.

Descriptors: *Eutrophication, *Phytoplankton, *Fluorometry, *Chlorophyll, *Aquatic productivity, *Biomass, Estuaries, Hawaii, Nitrates, Phosphates, Sewage, Nutrients, Food chains, Zooplankton, Primary productivity, Waste water disposal, Absorption.
Identifiers: *Trichromatic method, Kaneohe Bay (Hawaii), Chlorophyll a, Productivity index.

On each of a 4-month series of weekly cruises in Kaneohe Bay, Oahu, Hawaii, in vivo chlorophyll a was monitored continuously by fluorometry, and at 8 stations discrete measurements of chlorophyll a (trichromatic method), primary productivity (C), and nutrients (nitrate and phosphate) were made. The results are compared with similar data collected a decade earlier in the bay to investigate the enrichment effects of increased waste discharge over this period. The south sector of the bay, site of two sewage outfalls, showed the greatest population instability and had the highest concentrations of chlorophyll a, nitrate, and phosphate, as well as the highest primary productivity. Chlorophyll, nutrient concentration, and primary productivity decreased through the transition sector into the north sector of the bay, which is farthest removed from the waste discharge points. The productivity index (mg C fixed per hr per mg Chl a) showed no such south to north differences. A model of a simplified food chain using a hyperbolic relationship between uptake rate and substrate concentration is postulated to explain the dynamics of the plankton community in the bay. (Mortland-Battelle)
W72-03544

GROWTH RESPONSE OF BLUE-GREEN ALGAE TO ALDRIN, DIELDRIN ENDRIN AND THEIR METABOLITES,
Wisconsin Univ., Madison. Dept. of Entomology.
J. C. Batterton, G. M. Boush, and F. Matsumura.
Bulletin of Environmental Contamination and Toxicology, Vol. 6, No. 6, p 589-594, November/December 1971. 2 tab, 17 ref.

Descriptors: *Chlorinated hydrocarbon pesticides, *Aldrin, *Dieldrin, *Endrin, *Growth rates, *Cyanophyta, *Toxicity, Pesticides, Pesticide residues, Algae, DDT, Phytoplankton, Marine algae, Aquatic algae, Colorimetry, Traces.
Identifiers: Photodieldrin, Anacystis nidulans, Agmenellum quadruplicatum strain PR-6, Photoaldrin, Ketoendrin, Metabolites, Skeletonema, Anabaena cylindrica, Dunaliella.

The effects of dieldrin, endrin, aldrin, and five corresponding metabolites on the growth rates of two bacteria-free blue-green algal species were tested. The test species were Anacystis midulans (TX20), a freshwater isolate, and Agmenellum quadruplicatum strain PR-6, a marine isolate, both of which were grown in different media at the same pH, temperature, and light intensity. A comparison of the responses of the test algae showed that the marine isolate (PR-6) was generally more tolerant to the insecticide compounds than the freshwater isolate (TX20). There was an overall depression of growth rates with high concentrations (475 ppb, 950 ppb) of dieldrin and its metabolites. Of the parent compounds tested, aldrin had the least effect on either test species. The selected light intensity and temperature for optimum growth rates remained unchanged in the presence of the insecticide compounds. That PR-6 was generally the more tolerant of the two test species raises the question of the effect of medium composition upon insecticide toxicity. Tabular data show growth rates for experiments usually lasting 30-36 hours. (Holoman-Battelle)
W72-03545

THE RELATIVE IMPORTANCE OF NANNOPLANKTON AND NETPLANKTON AS PRIMARY PRODUCERS IN TROPICAL OCEANIC AND NERITIC PHYTOPLANKTON COMMUNITIES,
Stanford Univ., Pacific Grove, Calif. Hopkins Marine Station.
For primary bibliographic entry see Field 05A.
W72-03548

CONTINUOUS CULTURES OF NATURAL POPULATIONS OF PHYTOPLANKTON IN DILUTE, TREATED SEWAGE EFFLUENT,
Woods Hole Oceanographic Institution, Mass.
W. M. Dunstan, and D. W. Menzel.
Limnology and Oceanography, Vol. 16, No. 4, p 623-632, July 1971. 6 fig, 3 tab, 36 ref.

Descriptors: *Phytoplankton, *Sewage effluents, *Nutrients, *Seawater, Nitrogen, Phosphorus, Carbon, Chlorophyll, Rhode Island, Silicon, Copper, Iron, Manganese, Aquatic productivity, Biomass, Diatoms, Ammonia, Cultures, Toxicity, Absorption, Phosphates, Nitrates, Primary productivity, Heavy metals.

Identifiers: *Mercury, Nickel, Skeletonema costatum, Thalassionema nitzschioides, Asterionella japonica, Pennate sp., Cylindrotheca closterium, Licmophora lyngbei, Thalassiosira nordenskioldii, Paralia sulcata, Chaetoceros debilis, Leptocylindrus minimus, Thalassiosira levanderi, Guinardia flaccida, Nitzschia seriata, Eucampia zoodiacus, Rhizosolenia fragilissima, Pleurosigma angulatum, Chaetoceros compressus, Leptocylindrus danicus, Rhizosolenia delicatula, Sample preservation.

The effluent (containing some trace metals) from a secondary sewage treatment plant in Cranston, Rhode Island was used to study the effect of treated effluent on phytoplankton growth using a continuous culture system. Cultures were grown in Plexiglas vessels with a circulating-water jacket and inoculated with natural populations, which had been filtered through a 100 micron net. Seawater was added to the culture vessel and the effluent, which had been kept frozen in polycarbonate bottles, was pumped in. This system was monitored over a 1-year period for carbon production, chlorophyll, species, cell numbers, and nutrient uptake. Consistent plant nutrient ratios and similar properties of plant growth stimulation and level of toxicity were observed. Large quantities of plant carbon were produced with the concomitant removal of nitrogen and phosphorus from the effluent. The plant species that grew in the continuous culture were common to typical coastal phytoplankton, and the selection and elimination of species was gradual considering the chemical complexity of the sewage effluent enrichment. It appears that this system is particularly useful in studying algal succession. (Mortland-Battelle)
W72-03549

BIOLUMINESCENCE AND PHYTOPLANKTON SUCCESSIONS IN BAHIA FOSFORESCENTE, PUERTO RICO,
Johns Hopkins Univ., Baltimore, Md.
H. H. Seliger, J. H. Carpenter, M. Loftus, W. H. Biggley, and W. D. McElroy.
Limnology and Oceanography, Vol. 16, No. 4, p 608-622, July 1971. 8 fig, 4 tab, 20 ref.

Descriptors: *Bioluminescence, *Phytoplankton, *Meteorological data, Puerto Rico, Dinoflagellates, Copepods, Gastropods, Annelids, Water temperature, Salinity, Density, Winds, Sampling, Photometry, Chlorophyll, Mathematical models.
Identifiers: Pyrodinium bahamense, Bahia Fosforescente, Ceratium furca hircus, Gymnodinium splendens, Peridinium divergens, Ceratium fusus, Dinophysis caudata ventricosa, Pyrophacus horologium steinii, Peridinium oceanicum, Prorocentrum micans, Peridinium depressum, Cochlidinium polykrikoides, Oikopleura, Bivalves, Barnoiles, Trochophores, Tintinnids, Chlorophyll a.

Bioluminescence and phytoplankton successions during 1969 indicate large oscillations from the stable Pyrodinium bahamense populations normally associated with bioluminescent bays. Bioluminescent intensity of Bahia Fosforescente was measured by means of a towable underwater photometer. Plankton samples, taken with plankton nets, were observed both alive and stained in Rhode's iodine solution. Stimulated bioluminescence was measured in the laboratory using an electron multiplier phototube. Salinity and chlorophyll a were also determined during the sampling. Data from these surveys show the distribution of the bioluminescence, the temperature, salinity, and populations of the plankton at various locations. A mathematical model is proposed which relates meteorological conditions to positively and negatively phototactic dinoflagellate populations. The model and additional circumstantial evidence indicate that Bahia Fosforescente may no longer be a stable bioluminescent bay. (Mortland-Battelle)
W72-03550

AVAILABLE IRON: A LIMITING FACTOR FOR MARINE PHYTOPLANKTON,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 05A.
W72-03552

ANALYSES OF SPECIES DENSITIES BY THE MULTIVARIATE GENERAL LINEAR MODEL,
Smithsonian Institution, Washington, D.C. Museum of Natural History.
For primary bibliographic entry see Field 07C.
W72-03554

RESIDUES IN FISH, WILDLIFE, AND ESTUARIES - ORGANICHLORINE INSECTICIDE RESIDUES IN FISH - FALL 1969, NATIONAL PESTICIDE MONITORING PROGRAM,
Bureau of Sport Fisheries and Wildlife, Washington, D.C.
For primary bibliographic entry see Field 05A.
W72-03555

PRODUCTION AND BIOENERGETIC ROLE OF THE MIDGE GLYPTOTENDIPES BARBIPES (STAEGER) IN A WASTE STABILIZATION LAGOON,
Oregon State Univ., Corvallis. Dept. of Entomology.
R. A. Kimerle, and N. H. Anderson.
Limnology and Oceanography, Vol. 16, No. 4, p 646-659, July 1971. 5 fig, 5 tab, 27 ref.

Descriptors: *Energy budget, *Sewage, *Aquatic productivity, *Midges, Lagoons, Biomass, Oregon, Sludge, Algae, Diptera, Dissolved oxygen, Dredging, Bottom sediments, Stabilization, Primary productivity, Growth rates, Respiration.
Identifiers: Glytotendipes barbipes, Ekman dredge.

The bioenergetic role of a population of Glyptotendipes barbipes in the process of waste stabilization in two sewage lagoons was studied. Weekly production rates of the multivoltine midge were computed. Annual production of G. barbipes was 808 kcal/sq meter in a narrow band nearshore of the secondary lagoon containing 90 percent of the biomass. Biomass data from both lagoons in 1966 and 1967 were used to estimate production using a turnover ratio (TR) of 8.49 (ratio of production:mean biomass) from definitive data collected in 1967. Production in the secondary lagoon was 459 kcal/sq meter in 1966 and 37 in 1967; in the primary lagoon it was 165 and 18 respectively. The factors causing these differences in production were probably the dissolved oxygen concentrations during the growing season, percent of the total lagoon bottom inhabitable by midge larvae, and the condition of the sludge substrate. The total energy removed by emergence and respiration of G. barbipes was compared with the energy in both pathways in the lagoon: import of sewage, primary production, community respiration, storage, and export. In 1966, G. barbipes removed about 6.6 percent of the net primary production in the secondary lagoon and 0.5 percent in 1967. (Mortland-Battelle)
W72-03556

EFFECT OF WIDE TEMPERATURE FLUCTUATION ON THE BLUE-GREEN ALGAE OF BEAD GEYSER, YELLOWSTONE NATIONAL PARK,
Indiana Univ., Indianapolis. Dept. of Microbiology.
J. L. Mosser, and T. D. Brock.
Limnology and Oceanography, Vol. 16, No. 4, p 640-645, July 1971. 3 fig, 2 tab, 9 ref.

Descriptors: *Thermal pollution, *Water temperature, *Cyanophyta, Geysers, Photosynthesis, Cultures, Chlorophyll, Proteins, Algae, Growth rates, Tracers.
Identifiers: Yellowstone Park, Synechococcus, Flexibacteria, Phormidium, Mastigocladus, Pheophytin, Grassland Spring.

Measurement of photosynthesis and growth of cyanophyta in the drainway of a small geyser in Yellowstone indicates that fluctuating temperatures limit the extent of algal growth. An algal mat of 'Grassland Spring' was used in these experiments as an example of a mat occurring in a thermally constant environment. Photosynthesis was measured by the Carbon 14-bicarbonate method. Mat samples were also analyzed for chlorophyll, protein, and pheophytin. Algae from the mat were cultured in medium D. The mat was exposed to high temperatures only during the brief eruptions of the geyser. Since optimal temperatures for the algae were higher than the mean environmental temperature, temperatures optimal for photosynthesis and growth occurred only during a small fraction of the time. It was indicated that these algae were resistant to the high temperature that occurred during eruption, whereas organisms having the same optimal temperature but inhabiting a thermally constant environment were more heat sensitive. The data suggest that organisms may adapt to sudden temperature shocks, such as those experienced near steam power plants, but that they cannot evolve the ability to grow well throughout the temperature cycle. Such data may differ, however, in a more random situation, since this was a geyser that erupted predictably. Further study of randomly erupting geysers is suggested. (Mortland-Battelle)
W72-03557

A FRESHWATER 'RED TIDE' ON CLEAR LAKE, CALIFORNIA,
California Univ., Davis. Inst. of Ecology; California Univ., Davis. Dept. of Zoology.
For primary bibliographic entry see Field 05A.
W72-03559

MISCIBLE DISPLACEMENT OF 2,4-D HERBICIDE DURING CONSTANT LIQUID FLOW VELOCITY INTO INITIALLY DRY SOILS,
Florida Univ., Gainesville. Water Resources Research Center.
For primary bibliographic entry see Field 05B.
W72-03563

ABUNDANCE OF ETHMODISCUS IN PACIFIC PLANKTON,
Akademiya Nauk SSSR, Moscow. Institut Okeanologii.
For primary bibliographic entry see Field 05A.
W72-03567

METABOLIC FATE OF CYSTEINE AND METHIONINE IN RUMEN DIGESTA,
Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia).
For primary bibliographic entry see Field 05B.
W72-03623

MERCURY IN THE ENVIRONMENT.
For primary bibliographic entry see Field 05B.
W72-03644

RAPID UPTAKE OF MERCURIC ION BY GOLDFISH,
Cornell Univ., Ithaca, N.Y. Dept. of Entomology.
D. J. Lask, C. E. McKone, R. G. Young, and C. A. Bache.
Environmental Science and Technology, Vol 5, No 11, November 1971, p 1138-1139. 13 ref.

Descriptors: *Absorption, *Temperature, *Toxicity, Evaporation, Separation techniques, Hydrogen ion concentration, Water pollution effects, Path of pollutants, Fish.
Identifiers: *Mercury, *Mercuric ion, *Mucus, Alcohol extraction, Bacterial methylation, *Goldfish.

It has been shown that the mercuric ion, which is one of the major forms of industrial pollution, is rapidly absorbed from the water by goldfish. The

extent of absorption is dependent on mercury concentration and time of exposure. Other factors known to influence the toxicity of heavy metals to fish may also affect this uptake. Included in those factors are water hardness, temperature, pH, volume, the associated heavy metal anion, and the presence of other heavy metal ions. Mercuric ion in water, apparently as certain other heavy metals, is rapidly absorbed into the mucus externally secreted by fish, and its presence appeared to stimulate this secretion. Therefore, it was of interest to determine the proportion of 'absorbed' mercury which may have been present in the accumulated mucus. Of the total mercury, it was found that 79.3% was in the mucus. Jernelov (1970) has reported that bacterial methylation of mercury occurs when mercuric ion is incubated with dead fish but only if the mucus is present which may make these findings signficant. Work is underway to determine the kinetics of this methylation reaction and the fate of the methylated product (s) in fish. (Biggs-Texas)
W72-03646

EFFECT OF INSECTICIDES ON AN ECOSYSTEM IN THE NORTHERN CHIHUAHUAN DESERT,
Texas Univ., El Paso. Dept. of Civil Engineering; and Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences; and Louisiana State Univ., Baton Rouge. Fisheries Div.
For primary bibliographic entry see Field 03F.
W72-03673

CONTROL OF RED WATER DUE TO PIPELINE CORROSION,
American Water Works Service Co., Inc., Philadelphia, Pa.
M. E. Flentje.
Journal of the American Water Works Association, Vol 53, No 12, p 1461-1465, Dec. 1961. 1 fig, 2 tab, 6 ref.

Descriptors: *Water treatment, *Corrosion, Phosphates, *Calcium compounds, Hydrogen ion concentration, *Water pollution treatment, Water pollution effects, Color.
Identifiers: *Distribution systems, Public relations, *Red water, *Saturation index.

Red water from corrosion of unlined or unprotected cast-iron mains should not result in extensive consumer complaints if the CaCO3 saturation index is maintained within 1.0 unit of saturation. Between an index of about -1.0 and -1.6 red-water complaints can occur. Disturbances noticeable to the consumers due to rapidly opening valves and changes in velocity result in complaints. Water having a saturation index value below -1.6 can be expected to have a red color problem. These are general statements to be used as guides. Use of polyphosphates minimizes the need for pH correction considerably. Dosages of 2 ppm or more may be required and, with an index below -2.75, such treatment may not entirely eliminate red water. Figure shows the relationship between CaCO3 saturation values and iron picup. (Bean-AWWA)
W72-03705

BETA-OXIDATION OF FATTY ACIDS BY LEPTOSPIRA,
Massachusetts Univ., Amherst. Dept. of Microbiology.
R. C. Henneberry, and C. D. Cox.
Canadian Journal of Microbiology, Vol 16, 1970, p 41-45, 3 fig, 3 tab, 30 ref.

Descriptors: *Oxidation, *Biodegradation, Enzymes, *Pathogenic bacteria, *Metabolism, Water quality, Laboratory tests, Bacteria.
Identifiers: *Leptospira, Acyl-coenzyme A, Fatty acids, Carbon source.

Although long-chain fatty acids appear to serve as the major carbon and energy source for Leptospira, the pathway (s) by which these substances are oxidized by these organisms has not been described. Acyl-coenzyme A (CoA) dehydrogenase activity has been reported in cell-free extracts, and fatty acid degradation by B-oxidation has been suggested. Pathways for oxidation of these substrates become important in a consideration of the comparative physiology of pathogenic and non-pathogenic leptospires with the view of obtaining a better understanding of their virulence. The oxidation of both saturated and unsaturated fatty acids by a water isolate and a pathogenic leptospire has been studied. Evidence is presented for the existence of an adenosine triphosphate dependent fatty acid activating enzyme in the water isolate, and measurement of the reactions of B-oxidation in cell-free extracts of both strains is described. It was concluded that fatty acid degradation by B-oxidation constitutes a major catabolic pathway in Leptospira. (Goessling-Texas)
W72-03729

SOME FACTORS INFLUENCING VITAMIN B SUB 12 PRODUCTION BY PSEUDOMONAS DENITRIFICANS,
Merck Sharp and Dohme Research Labs., Rahway, N.J.
H. J. Daniels.
Canadian Journal of Microbiology, Vol 16, 1970, p 809-815, 1 fig, 8 tab, 18 ref.

Descriptors: *Denitrification, *Bacteria, *Vitamin B, Nutrient requirements, Laboratory tests, Vitamins.
Identifiers: *Pseudomonas denitrificans.

During the past two decades, several hundred investigations related to vitamin B sub 12 production have been reported. The interest displayed in this subject is better appreciated when one considers that vitamin B sub 12, in addition to being a growth factor for animals is also produced by large numbers of microbial genera. This study is of special interest since the bacterium used does not conform to the patterns established by other investigators, and many areas have been studied which have not been reported previously. The effect of known precursors and cofactors on vitamin B sub 12 production has been studied in a basal, chemically defined medium composed of sucrose, glutamic acid, and mineral salts. A carbon source, betaine, and Co (2+) were found to be essential for vitamin B sub 12 production. Known precursors such as methionine, '8'-aminolevulinic acid, succinic acid, and 1-amino-2-propanol had no effect. Glycine was inhibitory to growth. Oxalic acid, lactic acid, 5,6-dimethylbenzimidazole, and Mo (2+) stimulated vitamin B sub 12 biosynthesis. Of special interest is oxalic acid, which at a level of 0.04% w/v increased vitamin production about 20%, and with washed cells could replace glutamic acid, which had been demonstrated to be essential for both growth and vitamin B sub 12 production. When use of oxalate was followed it was found that this acid disappeared during the period of rapid growth and vitamin production and then reappeared during the final stages of the fermentation cycle. (Goessling-Texas)
W72-03730

PLANT-AVAILABLE PHOSPHORUS STATUS OF LAKES,
Wisconsin Univ., Madison. Dept. of Water Chemistry; and Wisconsin Univ., Madison. Dept. of Soil Science.
D. E. Armstrong, R. F. Harris, and J. K. Syers.
Available from the National Technical Information Service as PB-206 156, $3.00 in paper copy, $0.95 in microfiche. Technical Completion Report, Wisconsin Water Resources Center, Madison, 1971. 29 p, 2 tab, 20 ref, 10 append. OWRR B-022-WIS (6).

Descriptors: *Phosphorus, *Sediments, *Algae, *Eutrophication, Lakes, Aquatic plants, Iron, Microorganisms, Colorimetry, Wisconsin.
Identifiers: Available phosphorus, Exchangeable phosphorus, A*denosine triphosphate (ATP).

The factors controlling the available P status of lakes were investigated. The influence of sediment P on the P status of the overlying water was given primary attention. Sediments from several noncalcareous and calcareous Wisconsin lakes were investigated. Sediments contained large amounts of inorganic and organic P; generally more than one-half of the inorganic P associated with a gel complex dominated by short-range order hydrated iron oxides and hydrous oxides. Measurements of exchangeability using 32P showed that a large portion of the sediment inorganic P exchanged rapidly with P in the surrounding water. Investigation of the nutrient status of sediment microorganisms (ATP per cell relationships) and the ability of algae inoculated into sediment-water systems to utilize sediment P as their sole source of P indicated that a substantial portion of sediment P is available to organisms in close contact with sediments. Evidence based in part on comparison of 32P and inorganic phosphate measurements indicated that the Murphy and Riley (1962) colorimetric method provided valid information on the levels of dissolved inorganic P in lake waters.
W72-03742

PHOSPHORUS-33 AUTORADIOGRAPHY USED TO MEASURE PHOSPHATE UPTAKE BY INDIVIDUAL ALGAE,
Alaska Univ., College. Inst. of Marine Science.
Donald M. Schell, and Vera Alexander.
Limnol Oceanogr. 15 (6): 962-967. Illus. 1970.
Identifiers: Algae, Auto, Centrifugation, Diatoms, Individual, Measure, Phosphate, Phosphorus-33, Radiography, Uptake.

Diatoms from pure cultures and samples of lake phytoplankton were labeled with 33P, and autoradiographs were prepared after concentration by centrifuge and membrane filter techniques. Conditions for labeling at a suitable intensity (1-3 dpm/1000-micro 3 cell volume) were determined. The method is suitable for the detection of nonspecific binding of P by organic materials and of differential P uptake by members of a mixed population. It also was used to determine continuity of P uptake in a cultured diatom.--Copyright 1971, Biological Abstracts, Inc.
W72-03810

SANITARY-HYGIENIC CHARACTERISTICS OF METHYLPYRROLIDONE AS A WATER POLLUTANT,
Kiev Research Inst. of General Communal Hygiene (USSR).
K. F. Meleshchenko.
Gig Sanit. 35 (6): 84-85. 1970.
Identifiers: Biochemical, Dose, Hygienic, Index, Lethal, Methyl, Oxygen, Pollutant, Pyrrolidone, Sanitary, Standards.

Methylpyrrolidone in water imparts odor and taste at concentrations of 40-43 mg/l, while at concentrations of 4-50 mg/l it causes excessive biochemical oxygen demand (BOD), the oxygen demand index for this compound being 0.12. LD50 was established as follows (mg/kg): mice, 5320; rat, 7900; rabbit, 3500; guinea pig, 4400. Methylpyrrolidone showed no cumulative effect in test animals in chronic (6 mo) studies at doses of 0.025 and 0.25 mg/kg. The oxygen demand index should be used as the criterion for limiting discharge of this substance into natural waters.--Copyright 1971, Biological Abstracts, Inc.
W72-03815

EFFECT OF FISH POISONS ON WATER SUPPLIES, PART 2 - ODOR PROBLEMS,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
J. M. Cohen, G. A. Rourke, and R. L. Woodward.
Journal of the American Water Works Association, Vol 53, No 1, p 49-62, January 1961. 7 fig, 8 tab, 6 ref.

Descriptors: *Water treatment, *Fish control agents, *Solvents, *Toxicity, *Odors, Activated carbon, *Water pollution, *Water pollution effects.
Identifiers: Chlorine dioxide, Acetone, Isopropyl alcohol.

Presence of fish poison formulations in water supply present two basic problems, removal of the toxic component, and removal of odor to a level of potability. The latter is by far the most troublesome. Dosages of carbon required by various formulations were from 36 to 85 ppm. Such doses would be an economic burden if routine, but since fish poisons are applied infrequently the cost may not be great. Because of the high stability of toxaphene, sustained treatment with carbon is required. Solvents should be developed which are more suitable than those used: acetone and isopropyl alcohol. Solvents should produce little odor in water at 2 ppm concentration, be nontoxic to human and other mammals, be of known composition, and be readily dissipated by natural and biologic agencies after dispersion in water. Present solvents require more carbon than the poisons themselves. (Bean-AWWA)
W72-03828

EFFECT OF FISH POISONS ON WATER SUPPLIES, PART 3 - FIELD STUDY AT DICKINSON,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
J. M. Cohen, Q. H. Pickering, R. L. Woodward, and W. Van Heuvelen.
Journal of the American Water Works Association, Vol 53, No 2, p 233-246, February 1961. 6 fig, 8 tab, 3 ref.

Descriptors: *Water treatment, *Fish control agents, *Toxicity, *Odor, *Activated carbon, *Water pollution, *Water pollution effects.

Dickinson Reservoir with capacity of 5,800 acre-ft. was treated with 5,500 gal of liquid fish poison containing 2.5% rotenone, to kill the large coarse fish population before restocking with game fish. The degree of removal of toxicant and odor in the filter plant was determined by fish bioassay and threshold odor number. Permissible residual for fish toxicity was one-half the 96-hr median tolerance limit and for odor, a threshold number of 1. These values are equivalent respectively to 0.03 ppm and 0.013 ppm of fish poison remaining in solution after carbon treatment. With 2.0 ppm of fish poison, to reduce the toxicity to the desired level would require only 21 ppm of carbon. However, to reduce the odor to the desired level would require 59 ppm of carbon. Toxic components in the raw water decomposed rapidly and could not be detected at the end of 3 days. Odor components dissipated more slowly but could not be detected at the end of 6 days. (Bean-AWWA)
W72-03831

ALTERNATIVES FOR SALINITY MANAGEMENT IN THE COLORADO RIVER BASIN,
Federal Water Quality Administration, Denver, Colo.; and Federal Water Quality Administration, Alameda, Calif.
J. R. Vincent, and J. D. Russell.
Paper 71076, Water Resources Bulletin, Vol 7, No 4, p 856-866 Aug 1971. 11 p, 10 fig, 3 tab.

Descriptors: *Salinity, *Water quality, *Economic impact, Water management (Applied), Cost comparisons, Costs, Dissolved solids, Damages, Water resources development.
Identifiers: Salt water disposal, *Colorado River Basin, Cost Curves, *Alternatives, Salt removal.

The Colorado River Basin faces the dilemna of an increasing demand for water while presently struggling with salinity concentrations approaching critical levels for some water uses. Based upon projected development, salinity concentrations are predicted to exceed 1200 mg/l at Imperial Dam by the yr 2010. Annual losses to the basin economy resulting from increased salinity will exceed $50 million by the yr 2010. Although methods of controlling salt discharged are relatively unrefined, certain conclusions, based upon Bayesian statistical methods, can be reached. Five basic alternatives for coping with the problem are evaluated. Total costs associated with any alternative, or the resulting salinity, are the sum of salinity detriments (cost to users for water of increased salinity plus economic multiplier effects) and the cost of constructing salt discharge control works. These impacts upon basin economy and Colorado River water quality for each alternative are presented. (USBR)
W72-03925

CONTINUING STUDIES IN THE REMOVAL OF PHOSPHOROUS BY THE ACTIVATED SLUDGE PROCESS,
Los Angeles Bureau of Sanitation, Calif.
Robert D. Bargman, Jack M. Betz, and William F. Garber.
Chemical Engineering Symposium Series, Water – 1970, Vol. 67, No. 107, pp 117-121.

Descriptors: *Phosphorus, *Activated sludge, *Waste water treatment, *Sewage treatment, Sewage effluents, Cities, Phosphates, Enzymes, Nutrients, California.
Identifiers: *Phosphorus removal, *Los Angeles (Calif), Hyperion Treatment Plant.

The City of Los Angeles Hyperion Treatment Plant has been removing almost all of the phosphorous from a 100 million gal./day flow for a period of 16 months. Empirical control parameters suitable for Hyperion have been developed, and the process has proven to be repeatable and controllable. There is indication that a plug flow configuration is desirable for the process, and a stoichiometric balance between cations and the phosphate anion can be obtained if certain reactions are assumed. These conditions can also be repeated in the laboratory. However, further laboratory work with sludges and wastewaters from other local plants showed the Hyperion activated sludge to be unique in its ability to remove phosphorous. Addition of soluble organic carbon in the form of glucose made the sludge from one of the other plants capable of removing phosphorous. A proper carbon, nitrogen, phosphorous, and possible calcium and magnesium ratio may be necessary. Work is continuing on this. In any event, the characteristics of the sludge appear to be important, and the basic reaction may be an enzymatic one. (Poertner)
W72-03967

TECHNICAL PHOSPHORUS POSITION PAPER, A RESPONSE TO THE IPCB PROPOSED WATER QUALITY STANDARDS REVISIONS, NO. 71-14.
Metropolitan Sanitary District of Greater Chicago, Ill. Research and Development Dept.

September 1971. 14 p, 37 ref.

Descriptors: *Phosphorus, *Waste water treatment, *Algal control, *Aquatic algae, *Eutrophication, Municipal wastes, Cities, Phosphates, Illinois, Ecology, Tertiary treatment, Sewage effluents, Water reuse.
Identifiers: *Phosphorus removal, Chicago (Illinois).

The exact relationship between phosphorus concentration and aquatic growth is not known. Investigators report quite divergent opinions concerning the amount of phosphorus necessary for aquatic growth. Some have suggested that very low concentrations (less than .01 mg/l) are limiting, and some have suggested that even undetectable amounts will cause growth. Some investigators have suggested that other factors may be limiting. Phosphate removal processes are questionable and very difficult to control. Assuming that it may be possible to meet the limiting permissable phosphorus of 0.1 mg/l proposed by the Illinois Pollution Control Board (using coagulation-sedimentation of secondary effluent plus micro-filtration) the chemical costs alone have been estimated to be in excess of $18 million per year for the MSDGC. Capital costs for required dosing equipment and settling tanks would exceed $50 million. The increased sludge disposal cost to handle the additional solids generated by removing phosphorus would involve an annual cost of at least $9,000,000. Consequently, an additional estimated annual operating cost of $27,000,000 must be assigned to phosphorus removal compared to the present total annual cost of treatment of 10-14 million dollars. There is no substantial evidence to indicate that the limiting nutrient is phosphorus. Phosphorus removal at wastewater treatment plants which do not discharge to Lake Michigan does not appear at this time to be justified. (Poertner)
W72-03970

FINAL REPORT, PROVISIONAL ALGAL ASSAY PROCEDURES.
California Univ., Berkeley. Sanitary Engineering Research Lab.
D. F. Toerien, C. H. Huang, J. Radimsky, E. A. Pearson, and J. Scherfig.
Available from the National Technical Information Service as PB-206 140, $3.00 in paper copy, $0.95 in microfiche. Environmental Protection Agency, Water Pollution Control Research Series, SERL Report 71-6, October 1971. 211 p, 51 fig, 37 tab, 111 ref, 4 append. EPA Project 16010 DQB 10/71.

Descriptors: *Bioassay, Cultures, *Biomass, Nutrients, *Nutrient requirements, Nuisance algas, *Entrophication, Cytological studies, Analytical techniques, Pollutant identification.
Identifiers: *Chemostal assays, *Algal assay procedures, Selenastrum capricornutum.

Batch and continuous flow (chemostat) assays were investigated as part of a joint industry-government sponsored, multilaboratory effort to develop a standardized algal assay procedure for nutrient level assessment. Assays were conducted with Selenastrum capricornutum as a standard assay organism. Batch culture assays were found to have a lower level of precision than chemostat assays in the assessment of growth response as a function of nutrient concentration. The biomass parameter, maximum cell concentration, X, of the batch assay generally responded to the nutrient concentration of the sample; however, the chemostat biomass parameter, steady state cell concentration, X sub 1, always was found to be proportional to the nutrient concentration of the samples. The results of spiking tests with batch assays generally were inconclusive, with respect to identification of the growth rate limiting nutrient, whereas the results of spiking tests with chemostats indicated clearly the growth rate limiting nutrient. It is recommended that batch type algal assays be used only for crude screening or routine monitoring purposes and that the chemostat should be used for the quantitative assessment of the algal growth supporting properties of waters as well as for the development of kinetic descriptions for nuisance algae and the rate limiting nutrients of concern. A kinetic description of Selenastrum capricornutum indicated a low half saturation constant, K sub s, (the concentration of nutrient supporting one-half the maximum growth rate) of about 5 microgram P/l for phosphate phosphorus and a yield coefficient, Y, that varied as a function of growth rate. A theoretical model was proposed and evaluated which describes the varying yield coefficient (the result of 'excess' uptake) as a function of the growth rate (mean cell residence time). The function was verified experimentally at a very high statistical confidence level. The significance of these findings and their application to the practical problem of eutrophication assessment is presented. (EPA abstract)
W72-03985

GEOCHEMICAL CYCLES INVOLVING FLORA, LAKE WATER, AND BOTTOM SEDIMENTS,
Maine Univ., Orono. Water Resources Research Center.
Stephen A. Norton.
Available from the National Technical Information Service as PB-206 197, $3.00 in paper copy, $0.95 in microfiche. Maine Water Resources Center, Orono, June 1971, 14 p, 5 fig, 5 tab, 5 ref. OWRR A-018-ME (1).

Descriptors: *Diatoms, Geochemistry, Oligotrophy, Lakes, *Silica, Weathering, *Eutrophication, *Bottom sediments, Maine, Stratification.
Identifiers: *Beddington (Maine), Chalk Pond (Maine).

Chalk Pond, a shallow 21 acre pond near Beddington, Maine was monitored monthly for temperature, pH, total dissolved H4SiO4, Ca (++), Mg (++), Na (+), K (+), and A1 (+++). It was discovered that because of a high flushing rate, nearly daily variations in inorganic chemicals occur both horizontally and vertically within the pond; these mask organic and inorganic processes. Silica is depleted by as much as 25 percent in surface waters for several months after Spring turnover, primarily because of biological removal; bottom waters are commonly enriched in silica because of either groundwater contributions of silica-rich water or the solution of diatoms from sediment and/or inorganic constituents of the sediments. The pond volume is commonly stratified with concentrations increasing downward. The pond water is not in equilibrium with the inorganic sedimentary assemblage and is supersaturated with respect to congrunet solution of the inorganic silicates and aluminum silicates.
W72-03987

THE EFFECTS OF SELECTED FUNGICIDES AND SOIL FUMIGANTS UPON THE MICROFUNGI OF A CATTAIL MARSH,
Wisconsin State Univ., Oshkosh. Dept. of Biology.
L. L. Tews.
Wisconsin Water Resources Center, Madison, Completion Report. August 1971, 19 p, 8 tab, 6 ref. OWRR A-025-WIS (2).

Descriptors: *Fungi, *Pesticides, *Marshes, Fungicides, Fumigants, Wisconsin.
Identifiers: *Trichoderma viride, *Mucor hiemalis, Allen Marsh, Lake Butte des Morts.

Six commonly-used fungicides (Captan, Dexon, Dithane, Terraclor, Thiram and Zineb) and two commonly-used soil fumigants (Vapam and Vorlex) were applied to cultures of the predominant microfungi of a cattail marsh (Hansenula saturnus (Klocker) H. and P. Sydow, Mucor hiemalis Wehmer, Penicillium stipitatum Thom. and Trichoderma viride Pers. ex Fr.). Captan, Vapam, and Vorlex inhibited the growth of all four fungi at field concentrations. Those pesticides most inhibitory to the growth of T. viride in culture (Captan, Terraclor, Thiram, Vapam, and Vorlex) were applied to plots in a cattail marsh. In these field studies, only Vapam and Vorlex clearly reduced the number of microfungal propagules in the litter, water, and mud of cattail marsh; the results of the three fungicides were inconclusive.
W72-03992

FLUORIDE CONCENTRATION IN COASTAL AND ESTUARINE WATERS OF GEORGIA,
Skidaway Inst. of Oceanography, Savannah, Ga.
H. L. Windom.
Limnology and Oceanography, Vol 16, No 5, p 806-810, September 1971. 3 fig, 1 tab, 13 ref.

Descriptors: *Fluorides, *Estuaries, *Bottom sediments, *Georgia, *Sea water, Water chemistry, Chlorides, Saline water systems, Biodegradation, Salt marshes, Coastal marshes.

More than 150 coastal and estuarine water samples and 48 samples of interstitial water from salt marsh sediments were analyzed for fluoride using a specific-ion electrode method. Fluoride: chlorinity ratios do not attain normal ocean values until a chlorinity of 10-11% is reached. Interstitial waters are enriched in fluoride relative to surface waters of the same chlorinity. Enrichment involves uptake by salt marsh plants with subsequent release in the sediments due to bacteriological breakdown. (Knapp-USGS)
W72-04026

WATER CONTAMINATION BY CERTAIN HEAVY METALS,
General Electric Co., Schenectedy, N.Y.
J. S. Anderson, J. M. Phillips, and C. B. Schriver.
Preprint, presented at 44th Annual Conference of Water Pollution Control Federation, Session 10, No 3, October 5, 1971. 25 p, 3 fig, 6 tab, 16 ref.

Descriptors: *Water pollution, *Heavy metals, *Waste water treatment, Industrial wastes, Lethal limit, Public health, Chemical precipitation, Hydrogen ion concentration, Salts, Chelation, Reverse osmosis, Electrodialysis, Evaporation, Adsorption.
Identifiers: Complexing agents, Electroreduction.

Due to the increased interest in heavy metal contamination of water, it was decided that a general overview of this subject would be beneficial to plant personnel that will be faced with treating such wastes. The laws controlling effluent standards can be expected to become more stringent. Toxicity of the heavy metals and the effects on toxicity of combinations of these metals are presented and discussed. The safe limits, as they are now known, for water supply, animal water and aquatic life are presented in tabular form. Chemical precipitation of heavy metals is the most widely used means of removal. This is a simple operation but care should be taken to insure that factors influencing solubility of the metals, pH, salts, chelating agents, and complexing agents, are controlled for best results. A block diagram demonstrating the organization of a precipitation system is shown and discussed. With increasing standards, some form of secondary treatment for removing heavy metals must be considered. At this time, ion exchange is the most economic method which can provide low effluent concentrations. Other treatment processes such as reverse osmosis, electrodialysis, evaporation, electroreduction and adsorption can all produce the desired effluent quality, but each has special considerations that tend to limit general application. Heavy metal contamination will be an industry problem for some time. It's solution requires a full company-wide effort. (Goessling-Texas)
W72-04052

REMOVAL OF HYDROGEN SULPHIDE FROM WATERFLOOD INJECTION WATER,
Sohio Petroleum Co., Ohio.
For primary bibliographic entry see Field 05D.
W72-04064

NUTRIENT LIMITATION,
Ministry of Agriculture, Crumlin (Northern Ireland). Freshwater Biological Investigation Unit.
C. E. Gibson.
Journal Water Pollution Control Federation, Vol 43, No 12, December 1971, p 2436-2440, 2 tab, 12 ref.

Descriptors: *Nutrients, *Algae, *Eutrophication, *Phosphorus, *Nitrogen, Evaporation, Storm runoff, Bioassays, Bio-indicators, Storage, Flow rates, Inhibition, Analytical techniques, Enzymes, Color, Water quality control, Research and development.

Determination of limiting levels of nitrogen and phosphorus has been exceedingly difficult for several reasons. Inputs of phosphates and nitrates are extremely variable with season or with shifts in population. Secondly, the ratio of carbon to nitrogen to phosphorus is just as important as the actual amounts of each present. Thirdly, certain algae have a capacity for storing phosphates, and thriving algal growths may appear in areas where phosphate is seriously depleted. Perhaps the greatest difficulty encountered is the inability of researchers to develop a synthetic medium upon which algae will produce growth patterns similar to those of algae grown in streams or lakes. Phosphorus and nitrogen required by algae grown on synthetic media far exceed the supply available in any waters less than grossly polluted. However, advancements in bioassay techniques are continuing, and there is now a simple spot test for phosphorus limitation. Presence of alkaline phosphates has been shown to be an indicator of phosphate limitation, and a rapid color test has been developed. Teams of researchers are continuing to devote their attention to this and other new methods for obtaining information about nutrient limitation. (Lowry-Texas)
W72-04070

INSECTICIDE ADSORPTION BY LAKE SEDIMENTS AS A FACTOR CONTROLLING INSECTICIDE ACCUMULATION IN LAKES,
Wisconsin Univ., Madison. Dept. of Soil Science.
G. Chesters, and G. B. Lee.
Available from the National Technical Information Service as PB-206 303, $3.00 in paper copy, $0.95 in microfiche. Wisconsin Water Resources Center, Madison, Technical Completion Report, 1971. 9 p, 18 ref, 18 append. OWRR B-016-WIS (15).

Descriptors: *Pesticides, *Insecticides, *Adsorption, *Degradation (Decomposition), *Hydrolysis, *Sediments, Aquatic environment, *Organophosphorus pesticides, Wisconsin.
Identifiers: *Aerobiosis, *Organo-clay complexes, *Organochlorine insecticides, Unified analysis, Microbial systems.

The investigation was divided into three phases: development of methodology for determination of pesticides in aquatic systems, determination of the extent of pesticide adsorption on intact lake sediments and on isolated mineral and organo-clay fractions of lake sediments, and an evaluation of the rates and mechanisms of degradation of certain pesticides in the aquatic environment. Methods were developed for the unified determination of eight organo-chlorine and five organophosphorus insecticides at the 0.06 to 1.0 microgram/liter level. Extent of adsorption of gamma-BHC, malathion, and parathion on sediments was determined. The most important factors governing adsorption were pesticide, sediment ratio, sediment concentration, pesticide concentration, and organic matter content. The rate and mechanism of degradation of parathion was determined in intact lake sediments and simulated microbial systems; degradation was primarily microbial with the initial reduction of parathion to aminoparathion; further degradation was hydrolysis to diethylthiophosphoric acid and p-aminophenol. Gamma-BHC was detoxified in lake systems by microbial isomerization of the insecticide through alpha-, delta-, and beta-BHC; the reaction was much more rapid in anaerobic than aerobic systems. Hydroxy-atrazine degrades in sediment systems and partial cleavage of the stable s-triazine ring was indicated.
W72-04081

5D. Waste Treatment Processes

SUMMARY OF THE OCEANOGRAPHY AND SURFACE WIND STRUCTURE OF THE PACIFIC SUBARCTIC REGION IN RELATION TO WASTE RELEASES AT SEA.
Federal Water Quality Administration, Corvallis, Oreg. Pacific Northwest Water Lab.

Working Paper No. 76, September 1970. 66 p, 56 fig, 1 tab, 9 ref.

Descriptors: *Marine air masses, *Ocean currents, Air circulation, Aquatic drift, Density currents, Salinity, Temperature, Water quality control, Fish, Aquatic life, Plankton, Marine animals, Zooplankton, Atmospheric pressure, Nutrients.
Identifiers: *Prevailing winds.

Analysis of both prevailing current and wind direction and velocities was made from extensive studies of the literature for the Alaskan Gulf and the Pacific Ocean in the region known as the Pacific Subarctic. A counter-clockwise circulation was demonstrated to exist at all times of the year, creating a nearly closed circulation. Currents near the coast were shown to be fairly fast, with a jet-like stream passing south of the Kodiak, out along the Aleutian chain and into the Bering Sea. From these analyses, it was apparent that the wind and current systems in the Gulf will drive floating materials inshore for at least a few days every month at a rate of 3 to 5% of the wind speed. Therefore, there can be no safe dumping of wastes within this area if the extensive and unique biota of this area, both in-shore and at sea, are to be fully protected. (Lowry-Texas)
W72-03515

INFLUENCE OF ACID MINE WATER ON THE MICROFLORA OF SEWAGE,
West Virginia Univ., Morgantown. Water Research Inst.
For primary bibliographic entry see Field 05B.
W72-03531

FEASIBILITY OF TREATING WASTEWATER BY DISTILLATION.
Florida Univ., Gainesville.

Available from the National Technical Information Service as PB-206 145, $3.00 in paper copy, $0.95 in microfiche. Environmental Protection Agency-Research and Monitoring, Water Pollution Control Research Series, February 1971. 94 p, 11 fig, 25 tab, 43 ref. EPA Program 17040 DNM. Contract 14-12-571.

Descriptors: *Distillation, *Evaporators, *Waste water treatment, Separation techniques, Trickling filters, Activated carbon, Aeration, Temperature, Odor, Scaling, Pressure, Water reuse, Ammonia, Ion exchange, Desalination, *Long tube vertical distillation.

A long tube, vertical, three-effect evaporator was subjected to tests to determine effects of feed-water quality and evaporation conditions on product water quality, post evaporation polishing, and evaporator tube scaling. Feedwaters tested included effluents from extended aeration, trickling filter, and contact stabilization units. All units treated the same influent wastes. An odor free product could not be produced at temperatures between 112F and 290F, with the odor increasing as either the evaporator temperature or the feed-water COD increased. Preliminary studies demonstrated that while aeration could not always remove all the odor, activated carbon adsorption could. pH adjustment was shown to be incapable of controlling ammonia, but ion exchange provided sufficient removal. Scaling problems were prohibitive with trickling filter effluent but nearly negligible with extended aeration effluent. Increased efficiencies, at higher operating temperatures and negligible boiling point rise indicated that wastewater evaporation should be more economical than seawater evaporation. (Lowry-Texas)
W72-03610

A SYSTEM FOR INDUSTRIAL WASTE TREATMENT RD AND D PROJECT PRIORITY ASSIGNMENT.
Synectics Corp., Allison Park, Pa.

Available from the National Technical Service as PB-206 146, $3.00 in paper copy, $0.95 in microfiche. Environmental Protection Agency-Water Quality Office, Water Pollution Control Research Series, February 1971. 91 p, 13 fig, 14 tab, 28 ref. EPA Program 12000 FLX. Contract No 14-12-840.

Descriptors: *Cost benefit analysis, *Analytical techniques, *Digital computers, Industrial wastes, Water quality control, *Waste water treatment, *Research and development, Administration.

A computerizable analysis system for determining maximum benefit per increment of capital expenditure has been developed to aid the EPA in selecting those research projects which will provide the greatest amount of pollution abatement per dollar expended. Five main subsets with a total of 24 information sources are used to provide input, with the variables listed in terms of relative rankings rather than absolute values. The subsets are: (1) Effluent constituents; (2) Industrial groups; (3) State dimensions; (4) Project descriptions; and (5) General statistics. The system has been developed for implementation on the basis of aggregation of data on a state-by-state basis, but the geographical base may be readily expanded to include river basins, or contracted to run on a county by county basis. The system accounts for both past and current fundings of projects, allows policy decisions on the part of EPA management to be superimposed at several levels and permits analysis of the effects of various policy decisions. (Lowry-Texas)
W72-03611

BIOLOGICAL REMOVAL OF PHOSPHATES FROM AQUATIC MEDIA,
Arizona Univ., Tucson. Dept. of Biological Sciences.
Douglas Edwin Greer.
Master's Thesis, May 1971. 29 p, 4 fig, 4 tab, 23 ref. OWRR A-019-ARIZ (2).

Descriptors: *Phosphates, *Clams, *Algae, Chemical precipitation, Hydrogen ion concentration, Filtration, Colloids, Carbon dioxide, Calcium, Magnesium, Nutrients, *Waste water treatment, Tertiary treatment, Eutrophication.
Identifiers: *Anoxia.

The precipitation of excess phosphates in the form of hydroxyl-apatite has been accomplished without the addition of chemical reagents. The process requires elevation of the OH (-) ion concentration through the removal of CO2 from the water by algae, resulting in a hydroxyl-apatite algal suspension. This suspension is removed from the water by being filtered through beds of clams, Corbicula fluminea. These clams are able to survive in eutrophic water provided the water is continuously recirculated, and the temperature is kept below 30C. Estuarine phosphates may be even more susceptible to 'automatic' removal since sea water contains an average of 410 mg/l Ca (+2), which should result in more complete precipitation. Overall quality of water receiving clam-algae phosphate-removal treatment is enhanced, since pH elevation without lime addition results in Ca (+2) and Mg (+2) precipitation. Tertiary treated wastewater, subjected to nutrient removal and containing less than 0.30 mg/l total phosphates, will allow high levels of primary productivity without the danger of anoxia from excessive build-ups of the algal standing crop. (Lowry-Texas)
W72-03613

COAGULATION OF ACTIVATED CARBON SUSPENSIONS,
Northwestern Univ., Evanston, Illinois. Environmental Health Engineering.
R. D. Letterman, J. E. Quon, and R. S. Gemmell.
Journal of the American Water Works Association, Vol 62, No 10, October, 1970, p 652-658. 9 fig, 3 tab, 8 ref.

Descriptors: *Waste water treatment, *Water treatment, *Turbidity, *Coagulation, Activated carbon, Efficiencies, Hydrogen ion concentration, Alkalinity, Taste, Odor, Laboratory tests, Kaolinite.
Identifiers: Removal, Alum.

The coagulation phenomenon and its application to water treatment have been extensively studied. The use of activated carbon for taste and odor removal and of alum as a coagulant is widespread. The influence of the presence of activated carbon on coagulation has not received much attention. A series of laboratory tests at varying levels of turbidity, alkalinity, pH, carbon and alum additions have been conducted in an attempt to explore some of the ramifications of these interactions. The coagulation of carbon suspensions at pH 7.0 and alkalinity of 2 mg/l show that the alum dose associated with the first zone of coagulation is not sensitive to the initial concentration of carbon. The minimum residual turbidity increased with increasing initial carbon concentrations. The alum dose required to produce a water with a given turbidity increased with increasing carbon concentration. The optimum pH for coagulation was found to depend on the initial alkalinity. The addition of alum to carbon suspensions was more effective in turbidity removal than adding carbon to solutions of alum. Generally, the alum dose required to produce a residual turbidity of one unit was slightly less for kaolin suspensions containing carbon than for suspensions without carbon. (Goessling-Texas)
W72-03614

WATER TREATMENT PLANT AUTOMATION IN THE UNITED KINGDOM,
Binnie and Partners, London (England).
J. H. T. Griffiths.
Journal of the American Water Works Association, Vol 62, No 8, August 1970, p 473-482. 7 fig, 8 ref.

Descriptors: *Waste water treatment, *Water treatment, *Automatic control, Hydraulic valves, Water quality, *Treatment facilities, Automation, *Mechanical control, *Control system, Operations, *Operating costs.
Identifiers: Pneumatic handling devices, United Kingdom.

With the cost of a man capitalized at approximately $42,000 it has become necessary to look to automation for an answer to increased production costs. An account of the development of automation in the water treatment industry may be of some help to the operator. In 1949, Permutit installed a battery of four gravity filters with automatic wash capability. In 1952, the first plant with automatic filter wash and centralized control was commissioned at Broadside Works. The Sandford Mill softening plant introduced the use of grain handling techniques for the pneumatic handling of lime and soda ash. This led to automation of the storage, handling and preparation of chemicals. Automated sludge handling followed in 1956. The Elvington Works, commissioned in 1960, was the first fully automated water works in the U.K. The plant is manned 48 hours each week. The balance of th time, the plant operates under automatic control without operators. Provisions are made for alarm devices to signal standby personnel in the event of emergencies. Data logging is an essential part of automation to record the effectiveness of operations when no personnel are present. Full automation of the mechanical processes in a water treatment plant is reliable, efficient and can save staff. It will be increasingly adopted in the future. (Goessling-Texas)
W72-03615

METROPOLITAN SUCCESSIVE USE OF AVAILABLE WATER,
Colorado Univ., Boulder. Dept. of Civil and Environmental Engineering.
K. D. Linstedt, K. J. Miller, and E. R. Bennett.

Journal of the American Water Works Association, Vol 62, No 10, October, 1971, p 610-615. 4 fig, 6 ref.

Descriptors: *Waste water treatment, *Tertiary treatment, *Water reuse, Water quality, Water resources, Watershed management, Population, Growth rates, *Municipal water.

Nearly all metropolitan areas are confronted with an ever-increasing demand for high-quality supply waters. To meet this demand, municipal water departments must continually plan for the development of future sources of supply. The City of Denver is now involved in the development of a program leading to successive use of available water. This course of action was forced upon the city by an analysis of future water demands and future water sources. A study program has been initiated to evaluate all aspects of water reuse. The overall study includes the following components: (1) water reclamation process studies; (2) beneficial use studies; (3) study of the necessary alterations to the existing distribution system; (4) quality requirements for the possible beneficial uses; (5) evaluation of public acceptance of water successive use; (6) legal considerations. From a water resource point of view, there appears to be a definite need for developing the potential afforded by the concept of successive water reuse. However, there are many practical considerations that must be resolved in a major metropolitan area before successive water use can contribute significantly to the water resources of such a community. (Goessling-Texas)
W72-03616

WASTEWATER RECLAMATION.
National Industrial Pollution Control Council, Washington, D.C.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Price $0.30. Report COM-71-50083, March 1971. 31 p, 3 fig, 4 tab, 8 ref.

Descriptors: *Water reuse, *Return flow, *Water demand, Industrial wastes, Separation techniques, Tertiary treatment, Feasibility studies, Cost analysis, Sludge, Public health, Toxicity, Desalination, Water quality control, *Waste water treatment.

Gross withdrawals of water will exceed the ultimate supply of 650 billion gallons per day shortly after 1980. Technology needed to recycle wastewater is currently available, as evidenced by South Tahoe Wastewater District. Both industry and agriculture are already practicing limited reuse by treating some of their wastewaters to suitable levels and reusing them in places where a low-quality effluent can be tolerated. However, there are 8 major areas in which progress must be made before wastewater recycling will gain in popularity on a large scale. These progress needs are: (1) development of definitive public health and process engineering design criteria for total use of reclaimed water; (2) development of advanced monitoring and controlling instrumentation and techniques; (3) development of improved pollutant reuse methods; (4) initiation of a feasibility study of wastewater reclamation on a regional scale; (5) continuation of feasibility and pilot studies on wastewater desalting; (6) establishment of an inventory of water demands and sources according to user quantity and quality requirements; (7) determination of values of reclaimed waters for innovative uses; and (8) initiation of a program of public education on the need for water reclamation. (Lowry-Texas)
W72-03619

EVALUATION OF MIXING IN AERATION TANKS,
Freeport Water and Sewer Commission, Ill.
W. L. Paulson, S. C. Mehta, E. D. Toerber, and H. S. Smith.

Preprint presented at 44th Annual Conference of Water Pollution Control Federation Session 21, No 1, October 7, 1971. 32 p, 15 fig, 3 tab, 8 ref.

Descriptors: *Mixing, *Activated sludge, *Aeration, Dye releases, Tracers, Fluorescence, Baffles, Weirs, Analytical techniques, Design criteria, *Waste water treatment.
Identifiers: *Complete mixing, *Plug flow, Diffuser density, Mean residence time.

A Rhodamine dye-fluorometer tracer system was developed, tested under laboratory conditions, and used to evaluate the flow regimes in aeration tanks under varying conditions at the Freeport, Illinois Waste Water Treatment Plant. Primary effluent was used as the flow medium throughout the study. Each aeration tank was 25 ft x 675 ft. with a 13 foot water depth, and aerated by diffused air aeration. Longitudinal flow was used in the plug flow system and transverse flow was utilized in the complete mix system. Results indicated that it was possible to achieve complete mixing in the aeration tanks if inlet locations, effluent weir design, diffuser density, air flow and improvements in diffuser placement are used to achieve maximum utilization of tank volume. Mean residence time, n, for tanks in series model evaluation was near 1, and from 200 to infinity for the plug flow model as computed from the computer program. (Lowry-Texas)
W72-03620

INTEGRATED THEORY OF SEPARATION BY BULK CENTRIFUGES,
Alfa-Laval A.B., Tumba (Sweden).
J. R. Schnittger.
Industrial and Engineering Chemistry, Process Design and Development, p 407-412, 1970. 9 fig, 6 ref.

Descriptors: *Centrifugation, Analysis, *Mathematical models, Efficiency, Flow rates, Viscosity, Laminar flow, Particle size, *Waste water treatment.
Identifiers: Food industry, Chemical processing industry, *Solids concentration, Hindered settling.

Bulk centrifuges offer many advantages in processes handling large amounts of solids. An integrated theory is suggested for separation of solids in bulk centrifuges, such as decanters in the food and chemical processing industries. The governing separation process takes place in the laminar flow boundary layer 3 to 5 mm thick, with a free surface. The gradual, hindered settling of solid particles out of this layer, moving under the influence of centrifugal force and viscous friction, has been computerized. This has allowed, for the first time, calculations of absolute values of the sedimentation efficiency. The results are presented from the viewpoint of the plant engineer. Flow rate, concentration of solids, revolutions per minute, viscosity of liquid, particle size, and hindered settling influence the operation of a bulk centrifuge. A series of field tests is simulated on the computer. The values of efficiency versus flow rate are in good agreement with experimental ones using the same liquid, until excessive flow destroys the close validity of the model assumptions. Neither the designer nor the user of chemical processing equipment would be willing to abandon experimental testing. The ultimate proof of the process will continue to be its utility in the particular situation at hand. However, it must be of great value to have a basically simple concept for the main process of bulk centrifuges, particularly decanters, even if the computation may be complex. (Goessling-Texas)
W72-03621

CONSIDERATION OF SENSITIVITY AND PARAMETER UNCERTAINTY IN OPTIMAL PROCESS DESIGN,
Kansas State Univ., Manhattan. Dept. of Chemical Engineering.
M. S. K. Chen, L. E. Erickson, and L. T. Fan.

Industrial and Engineering Chemistry, Process Design and Development, Vol 9, No 4, p 514-521, 1970. 14 ref, 4 fig, 1 tab.

Descriptors: *Waste water treatment, *Design, *Optimization, Temperature, Efficiency, Flow rate, Sediment yield, Biochemical oxygen demand, Hydrogen ion concentration, *Optimal development plans, *Risks.
Identifiers: Holding time, Parameter variability, Uniform distribution, Normal distribution.

The biological waste treatment process is repeatedly subjected to changes in its operational parameters, such as flow rate, feed concentration, ambient conditions and others. Usually the optimal design variables are determined based upon a set of fixed numerical values of the parameters, such as the yield factor, flow rate, feed concentration, temperature, pH, and separation efficiency in the thickener. Much of the uncertainty introduced by these fixed values is not resolved until the system has been built and the operation observed. In an attempt to establish an approach to hedge against design errors caused by this uncertainty, a sensitivity analysis has been applied to reveal the important parameters in the optimal design of a two-stage continuous-flow stirred-tank reactor system with recycle. Specifically, a two-tank biological waste treatment system was examined to detect parameters to which the optimal holding time was most sensitive. The total holding time was most sensitive with respect to the efficiency of the thickener, next the recycle ratio, and thirdly the maximum specific growth rate. Several optimal design strategies which take into account parameter uncertainty are proposed. One of these, the expected value criterion, has been used to find new optimal results and quantitative safety factors for the two-tank biological waste treatment system. In general, the optimal holding time should be increased as the range of the uncertainty increases. Results are presented for both normal and uniform distributions of parameter values. (Goessling-Texas)
W72-03622

POPULATION DESCRIPTION OF THE NON--METHANOGENIC PHASE OF ANAEROBIC DIGESTION-II, HIERARCHICAL CLASSIFICATION OF ISOLATES,
National Inst. for Water Research, Pretoria (South Africa).
D. F. Toerien.
Water Research, 1970, Vol 4, p 285-303. 7 fig, 37 ref, 4 tab.

Descriptors: *Waste water treatment, *Anaerobic digestion, *Anaerobic bacteria, *Systematics, Bacteria, Animal populations.
Identifiers: *Non-methanogenic phase, Hierarchical classification, Divisive-monothetic, Agglomerative polythetics.

The need for bacteriological studies on the non-methanogenic phase of anaerobic digestion has been recently emphasized. Since the taxonomy of the anaerobic bacteria is in disarray it was suggested that other classification procedures should be investigated. A study has been completed to determine the suitability of hierarchical classification as applied to this group of bacteria. It was found that: (1) Divisive-monothetic classifications in the form of identification of isolates or by obtaining binary test batteries seem to have little or no value in ecological studies of the non-methanogenic bacteria of anaerobic digestion, (the disarray in taxonomy of anaerobic bacteria negates the use of identification procedures while general ecological propositions are difficult to make from the binary test batteries); and (2) agglomerative-polythetic classification of the non-methanogenic bacteria were highly successful because: (a) they demonstrated the presence of different groups of bacteria amongst the operational ecological units; (b) they yielded highly similar results; (c) the end product patterns of the groups were homologous; and, (d) the groups were

significantly different. Different physiological groups of bacteria therefore occur in the non-methanogenic phase of anaerobic digestion and each group showed an individual characteristic pattern. (Goessling-Texas)
W72-03624

PRELIMINARY STEPS IN WASTE TREATMENT,
MacDermid, Inc., Waterbury, Conn.
W. P. Innes, and W. H. Toller, Jr.
Plating, Vol 57, December 1970, p 1205-1208. 3 fig, 16 ref.

Descriptors: *Waste water treatment, *Design criteria, *Sewage, Thermal pollution, Water pollution control, *Standards, Operations, Treatment facilities, *Regulation.
Identifiers: *Pollution control, *Regulatory agencies, Finishing industry, Ohio River Valley Water Sanitation Commission.

Before a new finishing plant is opened it should go through a procedure for deciding how to meet pollution regulations. Every plant is subject to regulation by one or more governmental agencies, so the first step in waste control would be to determine the jurisdiction one's waste control falls under and then learn their regulations. A survey should be made to determine and classify all materials that constitute waste. While in the past many control agencies published specific concentrations of constituents in effluents, more and more agencies are using the term 'substantially complete removal.' A plan must be drawn up showing the method to be used to treat each waste, the equipment required, the location and daily operation of the equipment. After certification, the plan is submitted to the regulating agency. When approval is obtained, the equipment is purchased, installed and put into operation. In many areas it is possible to get financial tax relief to help defray the capital expense of the waste treatment facility. The cost of the treatment plant and its daily operation should be included in the pricing of all finishing jobs. Many plating plants, with adequate treatment, may find it necessary to recheck to see that new regulations can be met without modifications to their present waste control equipment. (Biggs-Texas)
W72-03625

NEW SYSTEM FOR DESALTING WATER.
For primary bibliographic entry see Field 03A.
W72-03626

PACKAGE PLANT OVERCOMES WATER SHORTAGE,
P. La Sollen.
Public Works, Vol 101, No 11, November 1970, p 74-75.

Descriptors: *Water treatment, Water shortage, Automatic control, Coagulation, *Flocculation, Filtration, Chlorination, Storage, Washington, Treatment facilities, Costs, *Waste water treatment, *Filters.
Identifiers: Modular construction, Pneumatic control, Filter media, *Ranier (Wash).

Perennial water shortages which regularly plagued the city of Ranier, Washington, were ended by the installation of an up-to-date water plant built around a modular, factory assembled treatment unit. The new plant, a Neptune MicroFLOC modular Aquarius system, went into operation in August 1968. Water is taken from an existing 250,000 gallon reservoir. A pneumatic controlled butterfly valve regulates flow into the plant over a weir. The flow is split into two equal portions for treatment by two parallel systems. Chemical treatment requires dry feeders for both alum and lime, a solution feed gas chlorinator and a polyelectrolyte-liquid batching system used for coagulant aid and/or filter aid. A mechanically agitated flocculator has a detention time of eight minutes. Each line has a tube settler with 5 degree inclined one inch hexagonal tubes. The settled water passes onto a multi-media filter bed. The filters use three media to form a filter bed with coarse media at the top and the fine at the bottom. Effluent water from the plant is pumped to a storage reservoir for use. The 500 gpm plant is modular and additional treatment lines can be added as needed. Total capital investment to include pumps and transmission lines was $359,000. (Goessling-Texas)
W72-03627

A REPORT ON THE CONTROL OF CHROMIUM IN PLATING SHOP EFFLUENTS.
American Electroplaters Society, Newark, N.J. Environmental Pollution Control Subcommittee.

Plating, Vol 57, September 1970, p 889-892. 2 fig, 2 tab, 12 ref.

Descriptors: *Chromium, *Sewage treatment, *Chemical reduction, Sewage sludge, Chemical precipitation, Oxidation-reduction, Filtration, Settling basin, Hydrogen ion concentration, Effluents, Coagulation, Adsorption, Separation techniques, *Waste water treatment.
Identifiers: *Control requirements, Reducing agents, *Electroplating, Batch treatment system, Rinse water, Extraction, *Chemical treatment.

For many years several methods of chemical treatment of chromium wastes have been known and used effectively. The most common procedure is the reduction of the hexavalent chromium to trivalent chromium, followed by neutralization and subsequent precipitation. Several different reducing agents may be used. Sulfur dioxide is commonly used, with the advantage being that no acid is required to cause the reaction to go to completion. Ferrous sulfate also is effective as a reducing agent, and it does not liberate a toxic gas. However, more sludge is generated with ferrous sulfate than with sulfur dioxide. Several alkalies such as hydrated lime, sodium carbonate, or sodium hydroxide are used to neutralize the reduced chromium. After the metal has been precipitated, the hydroxide and other solids usually must be separated. Filtration is difficult because of the gelatinous nature of the chromic system hydroxide, so a sludge thickener or settling area is usually bet can be operated on a batch or continuous basis. A proprietary system for the destruction of chromium wastes in which the hexavalent chromium is reduced in the proprietary rinse solution has been developed. Also, an electrolytic unit for the reduction of chromium rinse wastes was developed. Electrolysis takes place in a cell with a large cathode and anode area. This system reportedly lowers the cost of treatment. Evaporative systems are also suitable for recovery and reuse of rinse waters. At the present, several other systems for waste treatment are being developed including; coagulation-sedimentation, adsorption, foam flotation, electrodialysis, liquid-liquid extraction, and others. (Biggs-Texas)
W72-03628

EXPERIMENTS WITH MINERAL AND PLASTICS FILTER MEDIA.

Surveyor, Vol 135, No 4073, 1970, p 48-49.

Descriptors: *Waste water treatment, *Trickling filter, Effluent, *Biochemical oxygen demand, Efficiencies, Pilot plants, Economic analysis, *Filters, Filtration, Treatment facilities.
Identifiers: *Roughing filters.

One development of the percolating filter which has been pursued recently in Britain has been the high rate of roughing filter. While the traditional percolating filter has been rated at about 0.15 lb BOD/cu yd/day or 0.3 to 0.45 with recycling, or alternate double filtration, the high rate filter may treat 5 lb/cu yd/day or more, but it is not under such conditions to produce a standard or 20 BOD effluent. Rather it is expected to effect a large BOD removal which may amount to 40 to 70% of that present in the feed liquor. Mineral media for such filters would be expected to be large, on the order of 6 in., however, it is for just this purpose that the plastics media comes into its own. The primary requirement is for high void space and with a plastic media this can be on the order of 95%. The total surface area will be larger than that for mineral media. The development of this type of filter in Britain has been slow. Only recently have there been installations of this sort and these have been for special purpose treatment plants. Results to date have been varied. A comparison of the effluent quality, BOD removal rates and loading rates show the sensitivity of this type of filter to numerous parameters, some of which we may not have identified yet. This all points to the need for pilot plant tests prior to making a decision for an expensive installation. (Goessling-Texas)
W72-03629

SANITARY SEWER DESIGN FOR HYDROGEN SULFIDE CONTROL,
Pomeroy, Johnston and Bailey, Pasadena, Calif.
R. D. Pomeroy.
Public Works, Vol 101, No 10, October 1970, p 93-96 and 130. 3 fig.

Descriptors: *Waste water treatment, *Sewers, *Hydrogen sulphide, *Sulphur bacteria, Corrosion, Velocity, Temperature, Biochemical oxygen demand, Aeration, Waste dilution, Limestones, Plastics.

The presence of sulphide in sewers is, in nearly all cases the result of bacterial reduction of sulphate. Bacteria use oxygen to consume organic matter and when no oxygen is present, certain species obtain oxygen from the sulphate ion, which under favorable conditions leads to creation of hydrogen sulphide. Hydrogen sulphide in amounts sufficient to cause damage is not common, however, it is a matter of concern to those charged with the operation and maintenance of our sewer systems. An understanding of the reasons for the appearance of sulphides will allow the designer to avoid the conditions necessary for sulphide production or to guard against the effects of sulphides. Velocity, temperature and sewage strength all bear on the sulphide production problem. The designer is usually able to determine flow velocities. Temperature and sewage strength can be controlled by dilution water if necessary. Normally, these measures are adequate, however, if the sewer flows full for a sufficient length of time sulphides can accumulate. Air can be pumped into such lines to maintain aerobic conditions under such circumstances. Of the protective measures, probably the two most attractive are the use of limestone aggregate in concrete pipe and the use of PVC liners to protect conventional concrete. These measures can prevent damage by hydrogen sulphide in sewers. Occasional nuisance conditions will occur but these are usually of short duration and do little damage. (Goessling-Texas)
W72-03630

METAL FINISHING WASTES: METHODS OF DISPOSAL,
Industrial Filter and Pump Manufacturing Co., Cicero, Ill.
J. F. Zievers, R. W. Crain, and F. G. Barclay.
Plating, Vol 57, January 1970, p 56-59.

Descriptors: *Waste water treatment, *Flocculation, *Sewage sludge, *Neutralization, Sewers, Sedimentation, Design criteria, Hydrogen ion concentration, Settling basin, Centrifugation, Water reuse, Effluent, Alkalinity, *Oxidation lagoons, Waste disposal, Heavy metals, Industrial wastes.
Identifiers: *Lagooning, Vacuum filtration, Clarifier, *Metal finishing wastes.

Segregation and disposal of the heavy metals such as flocculated hydrates and some insoluable salts is of increasing importance owing to more stringent regulations and stricter enforcement. There are several methods of liquid-solid separation

available for treated metal finishing wastes. From the metal finisher's standpoint, disposal of neutralized wastes via the sanitary sewer is the cheapest. However, small sewers and state regulations drastically limit this method in its uses. Lagooning is the method that uses the least amount of equipment after sewering, but due to rainfall and temperature, and the poor settling in the water, lagooning cannot be used much today due to stricter enforcement of regulations. The baffled settling basin is another means of waste treatment, but the 'clears' from a properly designed basin would not be suitable for reuse unless processed by filtration. Disposal of neutralized waste by a clarifier sludge tank and vacuum filter is the most expensive method from an equipment standpoint. The 'clears' from the clarifier will generally be acceptable to a sewer, and in some cases a watercourse. Sometimes clarification is followed by centrifugation. Direct pressure filtration is more efficient than all methods discussed so far. With the properly prepared waste complete liquid-solid separation can be effected through a pressure filter. The ultra-high clarity filtrate can and now is being reused. Rising water and sewer costs make it desirable and economically sound to consider pressure filtration. (Biggs-Texas)
W72-03631

APPLICATION OF REVERSE OSMOSIS TO ELECTROPLATING WASTE TREATMENT,
Ontario Research Foundation, Sheridan Park.
A. Golomb.
Plating, Vol 57, October 1970, p 1001-1005. 4 fig, 4 tab, 8 ref.

Descriptors: *Reverse osmosis, *Effluents, *Waste water treatment, Ion exchange, Membranes, Design criteria, Waste effluent, Cost analysis, Pilot plant.
Identifiers: *Counter-current rinsing, *Flux rates, *Watts bath, Rinse water, *Electroplating, AES Project 31.

Reverse osmosis, originally developed as a separation technique for water purification of sea and brackish waters, now seems to be feasible as a pollution control measure for removing contaminants from plating waste streams. This method has been particularly favorable with application to nickel rinses. Recirculation of purified rinse waters and reuse of chemicals are made possible through the RO process. The heart of this process is the semipermeable membrane which permits the passage of water but acts essentially as a barrier to dissolved substances. Experiments conducted with rinse waters prepared by dilution of a Watts bath obtained from an industrial source gave nickel rejections of the order of 99+ percent. The membrane material used was Eastman Kodak Type RO-97, which is the grade having the highest rejection efficiency for inorganic salts. No significant deterioration in membrane properties occurred over a period of five months. The practical limit of nickel concentration is estimated to be about one-third of bath concentration at operating pressures of 600-1000 psi. A cost analysis for reverse osmosis showed that it was a potentially attractive method in economic terms for the recovery of nickel salts. Pilot-scale studies will be necessary, however, to provide accurate design and economic data before full-scale application of the process. (Biggs-Texas)
W72-03632

CARBONATION IN SODIUM BASE PULPING LIQUID RECOVERY PROCESSES,
T. T. Collins, and P. E. Shick.
Paper Trade Journal, Vol 154, No 25, June 22, 1970, p 39-49. 137 ref.

Descriptors: *Waste water treatment, Publications, *Reviews, Bibliographies, *Pulp wastes, Liquid wastes, Industrial wastes.
Identifiers: *Carbonation processes.

Many of the unit operations or variations used in carbonation recovery processes were anticipated by earlier work in the soda industry, even before sulphite pulping was known. A review of the patents and processes concerning the carbonation from 1819 is reported. The Stora process and later developments are discussed as well as the Sivola process, Mannbro carbonation and cross recovery process, the Mead process, the Collins process, Rayonier developments, Bratislava developments, Weyerhaeuser developments, Mo och Domsjo developments, the Tampella process and other miscellaneous carbonation processes. References for each of the processes and modifications are shown and the mechanisms briefly discussed. The chemical engineering aspects are touched upon as well as the adsorption and desorption rates. The Claus process is cited as being utilized in a number of the carconation processes. The carbonation approach has received continuous attention since the earliest days. A great many processes and variations have been proposed and a number have been tried in the mills. (Goessling-Texas)
W72-03633

OXYGEN SECONDARY WASTE TREATMENT CUTS POLLUTION CONTROL COSTS,
J. H. Olin.
Paper Trade Journal, Vol 154, No 24, June 15, 1970, p 31-32. 2 fig, 3 tab.

Descriptors: *Waste water treatment, Activated sludge, Oxygen, Biochemical oxygen demand, Chemical oxygen demand, Costs, New York, Treatment facilities, *Oxygenation, Aeration.
Identifiers: Suspended solids, Mixed liquor, Batvia (NY).

A new oxygen-based waste treatment system developed and recently introduced by the Union Carbide Corporation upgrades the performance of the activated sludge process used by both municipal and industrial plants. The 'UNOX' system has been demonstrated in laboratory bench scale and pilot plant tests and has been tried at full scale in the Batvia, N. Y. municipal waste water treatment plant. The aeration tank of a conventional activated sludge system is baffled to provide for several stages and the complete tank is covered to prevent the escape of oxygen. Pure oxygen is introduced in the first stage with influent waste and recycled sludge. The gas and mixed liquors are passed to subsequent stages and the effluent is settled in a conventional secondary clarifier. Comparative performance at full scale operation showed that BOD and suspended solids were reduced by a factor of two and COD was significantly less for the UNOX system as compared to activated sludge. Operating costs are estimated at half of those for conventional activated sludge and capital costs are lower. Union Carbide is ready to market this process on a broad scale to municipalities and to industries. The company feels that waste water treatment will become the nation's largest oxygen consumer by the 1980's. (Goessling-Texas)
W72-03634

ADVANCES IN POLLUTION CONTROLS ARE EXPLORED AT AIR/WATER CONFERENCE,
P. D. Van Derveer.
Paper Trade Journal, Vol 154, No 26, June 29, 1970, p 72-79.

Descriptors: *Water quality, *Pollution abatement, *Water reuse, *Filters, Activated carbon, Oceans, Photography, Legislation, Outlets, *Waste water treatment.
Identifiers: Multi-media, Homogenous, Snowflaking, Electro static precipitators.

The 7th annual meeting of TAAPI's Water and Air Conference was held June 7-10 in Minneapolis, Minnesota. Among the most significant papers presented at the conference were reports on: (1) a study of filtering media which showed that homogenous layer filters will produce water of the same quality as multi-layer filters over an equivalent period of time; (2) the use of activated carbon produced at the mill site for treatment and reuse of kraft mill effluent; (3) causes of snowflaking in precipitator operation; (4) the exploration of several different processes to eliminate effluents so that mills will not be prisoners of the receiving stream; (5) the use of photographic techniques to study dispersion of effluent from ocean (or lake) outfalls and eliminate dangerous boat sampling; and (6) the development of integrated, unified, incentive systems which make it unprofitable to pollute air, water and land. Some industries point with pride to the millions of dollars spent in controlling air and water pollution. The feeling is that industry should be given public recognition for its efforts in pollution control and the attendant publicity would alleviate some of the criticism of industry as a polluter. The author feels that the situation can not be so easily corrected, and that the public has good reason to be cynical about industry's ability or willingness to clean up its own mess. One answer to the pollution problem is the complete recycling of water and reclamation of usable material. This approach would be more meaningful to the public than a discussion on how little industry is polluting the environment. (Goessling-Texas)
W72-03635

RECOVERY OF PLATING WASTES: SELECTION OF LOWEST COST EVAPORATOR,
Pfaudler Co., Rochester, N.Y.
J. M. Culotta, and W. F. Swanton.
Plating, Vol 57, December 1970, p 1221-1223. 4 fig, 4 tab.

Descriptors: *Evaporators, *Evaporation, *Distillation, *Design criteria, Vapor compression, Chromium, *Waste water treatment.
Identifiers: *Rinse water, *Plating, Dragout, Volatile liquids.

Evaporative recovery of plating chemicals is an established technique for controlling pollution from plating shops, but the economics of this technique are complicated by a wide variety of possible combinations of processes and systems. The primary questions which the designer of a recovery system must answer are: (1) what size evaporator or distillation rate is required, (2) what materials of construction should be used, and (3) what type of evaporator should be selected. Single-effect, multiple-effect, or vapor recompression types of evaporators can be used with chromium recovery systems, but the high cost of reboiler surface area makes the multiple-effect and vapor recompression types less attractive than with cyanide recovery systems. Because plating solutions such as nickel, acid copper, and fluoborate types are corrosive in the concentrated liquid form and as distillates, the vapor recompression is virtually eliminated from consideration due to nonsuitable compressors. The success or failure of these special purpose systems depends not only on the choice of evaporator type and on the engineered details, but also on how they are integrated into the plating process. The installed cost is the sum of engineering, hardware, transportation, and installation. One significant part of the planning concerns the utility demands of the system. There are, however, so many variables in a cost analysis of placing an evaporator in a recovery system that each situation or examples of similar situations should be studied before a type of evaporator is decided upon. (Biggs-Texas)
W72-03636

HIGH RATE FILTRATION OF SEWAGE.

Surveyor, Vol 133, No 4003, 1969, p 34.

Descriptors: *Waste water treatment, *Trickling filters, *Efficiency, Economy, Biochemical oxygen demand, Temperature, Laboratory tests, Pilot plants, *Filtration.
Identifiers: Mineral media, Plastics media.

Despite a great deal of fruitful research on improving the efficiency of percolating filters it remains true that the bulk both of new plants installed and of existing plants still operated, are on the once through principle with about 60 gallons and up to 0.15 lb BOD/cu yd/day. The alternate double filtration process was first demonstrated in 1941 and was shown to double the amount of sewage that could be treated per unit volume. The full advantages of recycling filter effluent have been proven for an equal length of time. It is surprising that in this day of economy of operation, that neither of these processes have been widely adopted. The high rate filters using either the plastics media or a coarse mineral media have not been applied in situations where they could be used to good advantage. Future efforts should be made to increase efficiency and economy of operations by featuring these developments in the percolating filter treating domestic and industrial sewages. (Goessling-Texas)
W72-03637

PLASTICS MEDIA FOR PERCOLATING FILTERS.

Surveyor, Vol 133, No 4016, 1969, p 39.

Descriptors: *Waste water treatment, *Trickling filters, Biochemical oxygen demand, Efficiencies, Design, Cost comparison, *Filtration.
Identifiers: *Plastics media, Polyvinyl chloride, Mineral media.

The development of plastics media as an alternative for the conventional mineral media for the percolating filter, particularly for the high rate filter, represents an important advance in the technology of sewage and trade effluent treatment. Industry seems more amenable to the use of the plastics media, since they seem more concerned with a shorter time scale than the municipal authorities. The primary use envisioned for plastics media filters is to economically reduce large BOD loads prior to discharge into the municipal sewers. A review of the possible plastics available for use in this media presented and the reasons for selecting polyvinyl chloride as the most desirable were discussed. Alternative methods of using such filters for strong wastes or for municipal sewage were presented and discussed. A cost comparison of conventional filtration, alternating double filtration with and without preliminary roughing filtration was presented and showed that the roughing filter with plastics media followed by the alternating double filtration was by far the most economic configuration. (Goessling-Texas)
W72-03638

PLASTICS FILTER MEDIA IN SEWAGE TREATMENT.

Surveyor, Vol 138, No 4004, 1969, p 38-42. 7 fig, 2 tab, 5 ref.

Descriptors: *Waste water treatment, *Trickling filters, Pilot plant, Biochemical oxygen demand, Efficiencies, Cost analysis, Design, Construction, *Filtration.
Identifiers: *Plastics media.

Plastics media have long been talked about and experimented with. The signs now are that the industry is prepared to consider their more widespread use. At the present, plastics media are chiefly intended as roughing filters, removing large weights of BOD per unit volume of media at efficiencies of about 50-75%. The dose applied may be 5 lb BOD/cu yd/day or even more. Plastics media have the advantage of a high specific surface which leads to higher BOD removals and to higher hydraulic loads. Unit weight of the plastics is more than an order of magnitude less than that of mineral media and this allows considerably greater freedom to the designer. The large void volume enhances the oxygen supply throughout the media and makes forced aeration unlikely. There are several pilot plants under test in Britain for various applications. These vary from roughing filters to extend the life of currently overloaded plants to a preliminary removal of a large amount of BOD prior to discharge into the sea and finally to finishing filter to produce an effluent which meets the Royal Commission standards. The advent of the plastics media heralds a new era in percolating filters which will free the designer of the heavy civil engineering construction problems of the past and allow more flexibility. (Goessling-Texas)
W72-03639

18 BILLION POUND PROBLEM COMFRONTS AUTO MAKERS ANNUALLY.

Solid Wastes Management and Refuse Removal Journal, Vol 12, March 1969, p 18 and 34. 1 fig.

Descriptors: *Solid wastes, *Industrial wastes, *Waste disposal, Landfills, Incineration, Cost analysis, Flexibility, Compaction, *Waste treatment.
Identifiers: *Collection, *Separation.

General Motors Corporation, Ford Motor Company, and Chrysler Corporation dispose of an estimated 18 billion pounds of solid wastes annually. More comprehensive anti-pollution regulations, together with increased operating costs have shifted the emphasis from incineration to dumping, and contracts have been given to private disposal contractors in an attempt to retain flexibility while holding costs down. Collection and hauling to the processing area are normally handled by auto company employees and are accomplished using large caster mounted containers and one of several hauling schemes. The waste containers are strategically located throughout the plant and are towed to a central location when necessary. Material separation into salvable and non salvable material is centralized so that one main location may handle three or more plants. All processing and dumping equipment and their operators belong to the outside contractor. (Lowry-Texas)
W72-03642

DISPOSAL CREATES PROBLEM FOR CONTRACTOR.

Solid Waste Management and Refuse Removal Journal, Vol 9, No 11, November 1966, p 28-29. 3 fig.

Descriptors: *Solid waste, *Industrial wastes, *Incineration, *Landfill, Salvage value, Waste treatment.
Identifiers: Collection, Joint disposal facility, Public relations, Cooperative efforts.

Minneapolis company, in business 30 years, began by collecting scrap, then expanded into industrial and commercial service using the same equipment. Art Willman, the founder of the company, began by hauling scrap with a single truck in 1941. His son joined the company in 1952 and helped to expand the business into general commercial and industrial refuse hauling. Gradually outmoded, hand loaded equipment has been replaced by Heil Load Lugger's with containers of different sizes to meet the needs of the customer. The expanded hauling business has created a real disposal problem. The city operates two incinerators which can handle all of the burnable material collected in the downtown area. The non-combustible material that has no salvage value and the material collected in the outskirts must be disposed of elsewhere. Landfills able to handle this residue are scarce and the city does not appear to be interested in coordinating a solution to this sort of problem. The railroad has the authority to stop the lease on short notice. Just recently, the Minneapolis and Suburban Refuse Association has started to try to resolve the problem. Under consideration is a jointly operated disposal facility, a public relations campaign to educate the population on the need for a good landfill and closer cooperation with municipal officials to work out mutual problems. (Goessling-Texas)
W72-03643

A DIFFERENT APPROACH TO OXIDATION OF BLACK LIQUOR,
H. L. Freedman.
Paper Trade Journal, Vol 154, No 23, June 8, 1970, p 50-51. 1 fig.

Descriptors: *Waste water treatment, *Pulp and paper industry, *Oxidation, Efficiencies, Foaming, Nitrogen, Oxygen, Air.
Identifiers: Weak black liquor, Recycle, Ashbrook dual vortex contactor.

Deterrents to black liquor oxidation are both technical and financial in nature. An Ashbrook dual vortex contactor or 'Bloxidizer' has been tested on a variety of black liquors to determine its effectiveness. Both the liquor and the gas (air or oxygen) are inserted into the contactor tangentially under pressure. The vortex formed by the moving fluids intimately mixes them. High shear mixing is produced at the base of the vortex where the direction and velocity of flow is abruptly changed. The effluent exists through an opening in the unit's lower side. Pilot trials were conducted a three U.S. mills with the following results: (1) Southern softwood WBL- the unit will give complete oxidation if the retention time is long enough (3-4 minutes); (2) Northern softwood WBL-98% oxidation and with oxygen there was no foam; (3) Northeastern hardwood WBL-complete oxidation with 0.7-1.0 cu ft. of air per gallon of liquor; and, (4) the use of oxygen inhibits the production of foam since it is the nitrogen in air that contributes to foam production. The first mill installation was made in 1969 with a unit about six feet high and five feet in diameter with a capacity of 1,000 gpm. The unit increased the efficiency of operations from 50-60% to 95-100%. (Goessling-Texas)
W72-03645

CONTINUOUS THICKENING OF FLOCCULATED SUSPENSIONS,
Council for Scientific and Industrial Research, Pretoria (South Africa).
K. J. Scott.
Industrial Engineering Chemical Fundamentals, Vol 9, No 3, p 422-427, 1970. 18 ref, 6 fig, 2 tab.

Descriptors: *Waste water treatment, *Water treatment, *Sludge disposal, Theoretical analysis, Compaction, *Flocculation, *Suspension.
Identifiers: Sludge thickening, Observed thickening behavior.

The observed continuous thickening behavior of aggregated calcium carbonate suspensions and of lime-flocculated superfine silica suspensions were found to differ from the behavior predicted for an ideal pulp in an ideal thickener. A model that explained the observed behavior of flocculated pulps was presented at the time but it was speculative in some aspects and direct experimental confirmation was therefore required. A study has been completed which confirms these postulations. A pyrophyllite slurry was flocculated with lime and fed continuously to a 6 ft diameter Denver thickener of conventional design. Tests were conducted using quiescent settling and slow stirring. The results indicate that; (1) mild stirring reduces channeling and results in settling rates that agree more closely with those observed in an operating thickener; (2) the Talmage and Fitch test gives results which are equally reliable and, experimentally, the method is less involved; (3) the second mud zone which appears in the thickener profile when operating at high underflow densities is a true compaction zone and settling rates in this zone are virtually zero in the absence overlying solid and increase with increasing depth of the zone; (4) unlike the upper zone in fully loaded

thickeners, the compaction zone does not disappear when the throughput is reduced, nor does it appear when the thickener produces an underflow pulp less concentrated than the flocs. (Goessling-Texas)
W72-03647

TRICKLING FILTER WITH PLASTIC MEDIA HIGHLY SUCCESSFUL IN POLLUTION REDUCTION.
Georgia Kraft Co., Rome.

Paper Trade Journal, Vol 154, No 43, October 26, 1970., p 57.

Descriptors: *Trickling filters, *Organic loading, *Pulp wastes, Pulp and paper industry, Industrial wastes, Sedimentation, Aeration, Oxidation lagoons, Biochemical oxygen demand, Construction costs, Operation and maintenance, *Waste water treatment, Filtration.
Identifiers: *Synthetic filter media, *Kraft mill wastes.

An 80 ft. diameter, 30 ft. high trickling filter packed with a vinyl core material having 97% void space was constructed in 1961 for a kraft mill of the Georgia Kraft Company. The depth of the actual filter bed is 20 ft. and the unit contains 370,000 lbs. of Koroseal in prefabricated 2' x 2' x 4' modules. The tower handles an average daily load of 56,000 lbs BOD and provides 50% BOD removal. The filter is followed by a clarifier and 5 aerated lagoons, with a total BOD reduction through the system in excess of 70%. A detention time of only 2 1/2 days in the aerated lagoons is standard, whereas 8 to 15 days detention time is normal for wastes which have not been pretreated. The filter tower occupies only 1/20 the land area needed for a comparably sized rock filter. The tower has been in use for 9 years and is expected to last for at least another 15 years. (Lowry-Texas)
W72-03649

AN AUTOMATIC ELECTROLYTIC RESPIROMETER-ITS CONSTRUCTION AND USE,
Water Pollution Research Lab., Stevenage (England).
H. A. C. Montgomery, A. B. Oaten, and D. K. Gardiner.
Effluent and Water Treatment Journal, Vol 11, No 1. 9 p, 5 fig, 25 ref.

Descriptors: *Waste water treatment, *Biochemical oxygen demand, Chemical oxygen demand, Measurement, Oxygen demand.
Identifiers: *Oxygen consumption rates.

An automatic respirometer suitable for measuring oxygen consumption rates up to over 200 mg/l has been developed. The instrument is in two parts, a constant-temperature water bath which holds up to six reaction flasks and a control console. The reaction flask is a 5-neck quick demountable flask. The control console is programmed to interogate the functioning of each reaction every minute and record whether the cell is consuming oxygen or not as a function of whether or not current is flowing in an electrolytic cell. The result is a series of times on the printout which can be associated with a known increment of oxygen. Procedures for operating the device are given. Sources of error such as failure to absorb carbon dioxide, changes in barometric pressure and oxygen deficiency are discussed and means to circumvent these errors are discussed. Sensitivity and performance data is presented. Examples of the use of the instrument in treatability studies are described. The automatic respirometer developed at the WPRL is a valuable tool in determining the treatability of wastes. (Goessling-Texas)
W72-03650

WE ARE NOT RUNNING OUT OF WATER,
G. E. Symons.
Water and Wastes Engineering, Vol 7, No 7, p D6-7, July 1970.

Descriptors: *Water supply, *Water shortage, Water quality, *Water reuse, Analytical techniques, Waste water treatment, Water loss.
Identifiers: Accounting procedures, Recycling.

In the past several years, many writers and speakers have proclaimed that 'we are running out of water,' - that by 1980, 1990 or 2000 this country will need more fesh water than will be available. Most of the statements have been based on engineering survey reports by federal agencies, particularly on U.S. Geological Survey reports. Unfortunately, the public statements and the scare headlines have been quoted out of context or have been rather loose interpretations of technical reports issued by engineers and scientists. Contributing to this problem are the methods used by some agencies in calculating the water requirements. The USGS calculates the need for water along a water course without considering the amount of water withdrawn, used, treated and returned to the stream. This total requirement is then compared with the dry weather flow to determine the adequacy of the water supply along the stream. The failure to consider water reuse can lead to an erroneous conclusion that cities along the stream are short of water. Examples of this accounting approach to water requirement versus supply show that the Neosho River does not have adequate dry weather flows now to supply the cities along it banks when in fact the downstream water users are usually well supplied, albeit, with once or twice used water. We need to take a more practical approach to the problem of the adequacy of water supplies in order to provide a more realistic analysis of the situation. (Goessling-Texas)
W72-03651

THE FOREST ENVIRONMENT--PROBLEMS AND PROMISES,
Oregon State Univ., Corvallis. Dept. of Forest Engineering.
For primary bibliographic entry see Field 04A.
W72-03720

THE CONCEPT OF WASTEWATER RECLAMATION,
Cornell, Howland, Hayes, and Merryfield/Hill, Corvallis, Oreg.
L. G. Suhr.
In: Technology and Management of the Environment, Seminar, Oregon State University, Water Resources Research Institute, p 33-49, July 1971. 3 fig, 2 tab.

Descriptors: *Pollution abatement, *Reclaimed water, *Waste water treatment, *Recirculated water, *Water reuse, Environmental sanitation, Industrial wastes, Municipal wastes, Sewage bacteria, Dissolved solids, Potable water.

The concepts of wastewater reclamation versus its antithesis, that wastewater is fit only for disposal, are discussed. Probably the most important aspect of wastewater reclamation is pollution abatement. Biological oxygen demand in natural waters is lowered and there is less loss of desirable fauna. The lessened P and N levels in turn lessen eutrophication dangers. The reclaimed waters may be used in agriculture, industrial processes, groundwater recharge or domestic recyling. The economic advantages that may be gained are illustrated by the Las Vegas, Nevada situation where the estimated net costs of recycling may be less than the cost of merely retreating waste water for disposal, and Colorado Springs where recycled effluent provides 2 qualities of non-potable water. Past reclamation projects described are those of Chanute, Kansas, Windhoek, South-West Africa, South Lake Tahoe, California and Denver, Colorado. The treatment process and removal efficiency for the South Tahoe plant are detailed. The major problems of reuse involve bacterial and viral content and dissolved solids content. Much public education will be necessary in order to gain widespread acceptance of recycled domestic water. (See also W72-03716) (Casey-Arizona)
W72-03721

SUBLTE ASPECTS OF ECO-SYSTEM MANAGEMENT,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06G.
W72-03723

MAINE FOUNDATION MARKS TWENTY YEARS OF EDUCATION AND RESEARCH.

Paper Trade Journal, Vol 154, No 18, May 4, 1970. p 42-45, 1 fig.

Descriptors: *Waste water treatment, *Pollution abatement, *Education, *Research and development, Mathematical models, Biochemical oxygen demand, Dissolved oxygen, Salinity, *Pulp and paper industry, *Maine.
Identifiers: Public relations.

Progress in environmental research and recruiting came under the spotlight at the University of Maine's Pulp and Paper Foundation twentieth, annual open-house research day festivities. A ten man panel consisting of representatives from industry, the faculty and the student body discussed recruiting. Speakers highlighted the industry's contribution to pollution abatement and called for a complete dedication to the precept of efficient production with maximum concern for the environment. A subsequent speaker indicated the necessity for an effective public relations program to inform the public of those actions taken to reduce contamination of the surroundings. Researchers spoke of studies of the Penobscot River concerning the BOD loadings imposed on the receiving stream and the decreasing trend in these loads. A mathematical simulation of the river is being developed to predict the impact of organic loadings and to assist in determining the optimum loads and timing of discharges to obtain maximum benefit. Aeration by mechanical means was discussed and possibilities pertinent to the area were presented. Aeration as a means of destratifying lakes was discussed. The two day session attracted some 200 members of the pulp and paper industry. (Goessling-Texas)
W72-03725

UPSET AND RECOVERY OF A LARGE SLUDGE DIGESTION SYSTEM,
Baltimore City Dept. of Public Works, Md. Waste Water Div.
W. A. Hasfurther, and B. A. Kailer.
Preprint, presented at 44th Annual Conference of Water Pollution Control Federation, Session 11, No 2, October 5, 1971. 22 p, 6 fig, 1 tab.

Descriptors: Maryland, *Digesters, *Waste water treatment, Digestion, Pumps, Sludge, Hydrogen ion concentration, Temperature, Lagoons, Trickling filters, Heat exchangers, Alkalinity, Boilers, Piping systems, *Sludge digestion, Treatment facilities.
Identifiers: *Baltimore, *Back River Waste Treatment Plant, Gas production, Volatile acids.

An upset in the 170 MGD Baltimore Bark River Wastewater Treatment Plant, caused by lack of communication between operating and supervisory personnel and the assumption that the plant supervisors recognized the care needed to control the digestion process, led to changes in supervision, physical plant and operation procedure, and increased loadings far above those previously practiced. In November 1968, it was learned that all digesters were upset and that gas production had practically ceased. Volatile acids ranged from 2700 to 3400 mg/l, pH was below 6.6, and temperatures were below 85F when the discovery was made. An immediate check of recent data follow-

ing notice of digester failure showed that no toxic metals or compounds were present. A review of the routine laboratory data indicated however, that the contents of the heated digesters had been deteriorating for over a month before failure. High loading, poor mixing of the contents, inefficient heating, shock feeding and sludge removal and failure to use laboratory analyses as a process guide all contributed to the upset. In recovering the digesters the almost daily review of the physical and laboratory data and the early adjustment of operations in accordance with that data was of prime importance. The object was to get a completely mixed actively digesting material in one digester so that it could be used to help the other digesters in their recovery. After improvements in the pumping piping system and gas mains were made along with installation of a temporary gas recirculation system and a slight change in colatile acids concentration, tank loadings were increased from 60,000 to 120,000 gallons per day in three digesters. (Biggs-Texas)
W72-03727

POLLUTION CONTROL AND THE PLATING INDUSTRY,
K. R. Coulter.
Plating, Vol 57, December 1970, p 1197-1202, 6 fig, 1 tab, 5 ref.

Descriptors: *Sewage treatment, *Effluents, *Sludge disposal, *Waste storage, Hydrogen ion concentration, Settling basins, Waste storage, Filters, Flocculation, Reverse osmosis, *Waste water treatment.
Identifiers: *Electroplating, *Clean Water Restoration Act (1966), Federal Water Control Act (1965), Liquid-solid separation, Batch treatment, Continuous flow treatment, Precipitates, Settling techniques, Reactants.

Pollution control in the plating industry is a constantly changing and increasingly controversial area. In the United States, the passing of the Federal Water Control Act in 1965 and the Clean Water Restoration Act of 1966 brought into being a unifying force for the control of pollution. Although more pressure is being put on industries, the general tightening of funds to all governmental agencies is influencing the rate of enforcement. Industry has adopted delaying tactics because of cost with little or no return, lack of knowledge, and a feeling that there must be a better way. Some basic problems with most of the systems that haven't operated properly were wrong information, mechanical failures, incompetence in installation, personnel, bad engineering, cost, insufficient space, inadequate operating personnel. While the older treatment plants use batch treatment, most of the systems installed today use continuous flow approaches. Package units now offered use instrumentation for controlling treatment. Additional settling facilities and/or filtering equipment are still required. Recovery systems are growing in popularity because of water and sewer cost increases. With a recovery system the water may be recirculated and plating chemicals collected. Liquid-solid separation is a problem which has usually escaped a satisfactory solution. Only a very few equipment suppliers have found the key to design there. On the average the complete treatment system will cost from $70,000 to $90,000. However, future improvements will bring costs down a little. (Biggs-Texas)
W72-03728

PHOSPHORUS REMOVAL IN CONVENTIONAL TREATMENT AND FUTURE DESIGN CONSIDERATIONS,
F. Edwin Barth.
Proceedings, Pittsburg Sanitary Engineering Conference, 8th, Pittsburg, Pennsylvania, February 1970, p 15-29, 6 fig. 2 tab.

Descriptors: *Phosphorus, *Detention time, *Sludge treatment, Biochemical oxygen demand, Nitrification, Effluents, Dissolved oxygen, *Waste water treatment.

It is wise to consider that eventually the quality of effluent of the treatment plants will have to be upgraded. To ease this transition to higher quality requirements the following points should be considered: provide a small lab for future expansion, leave an expansion space between conventional unit processes, provide operational flexibility, provide flexibility in the detention time, provide for positive sludge control and realize that 95% BOD removal will require a nitrified effluent. The estimated phosphorus discharged to water systems is 610 million lb/year. The parameters that are necessary for efficient biological removal of phosphorus are: climanate digestor supernatant recycle, aeration time, and rate of air supply, concentration of MLSS, concentration of DO in aerator and period of sludge retention in secondary clarifier. (Rayaan-Texas)
W72-03731

PHOSPHORUS REMOVAL BY CHEMICAL ADDITION DURING SECONDARY TREATMENT,
Richard C. Brenner.
Proceedings, Pittsburg Sanitary Engineering Conference, 8th, Pittsburg, Pennsylvania, February 1970, p 57-88, 22 fig.

Descriptors: *Phosphorus, *Mineral, *Activated sludge, Effluents, Sludge, Sewage, Organic loading, Iron, Aluminum, Alkalinity, Trickling filters, Sedimentation, *Waste water treatment.

A description of mineral addition to activated sludge system is presented. The alternative application points are: primary effluent, mixed liquor, exit to clarifier, sludge recycle, and raw sewage. The chemical additives are: aluminum salts and iron salts. Low capital expenditure, reduction of liquor settling characteristics and reduction of effective organic loading are some of the advantages of mineral addition to the secondary system. Comparison of iron and aluminum, aluminum sulfate and sodium alum aluminite are listed. Some of the side effects of mineral additions are: alum and ferrous and ferric sulfate introduces sulfate ions to the system while aluminate introduces sodium ions. Results of pilot and full scale experiments indicate that aluminate is better suited to low to moderately low alkaline waste water while alum and iron compounds are better suited to moderately high to highly alkaline waste water. Recommendation for site of phosphorus removal for the following plants: primary sedimentation, trickling filter, activated sludge, and advanced waste treatment, are listed. (Rayaan-Texas)
W72-03732

PHOSPHORUS REMOVAL BY SINGLE-STAGE LIME TREATMENT OF SECONDARY EFFLUENT,
A. Carl Brunner.
Proceedings, Pittsburg Sanitary Engineering Conference, 8th, Pittsburg, Pennsylvania, February 1970, p 89-98, 3 fig, 2 tab.

Descriptors: *Phosphorus, *Lime, *Hydrogen ion concentration, *Waste water treatment, Filtration, Pilot, Sludge, Cost.
Identifiers: Calcination.

The chemistry of phosphorus removal and the reactions taking place is reviewed. Single stage treatment refers to treatment in which the water is maintained at a single pH value from the time lime is added until the water leaves the treating equipment. In this method sufficient lime slurry is mixed with water to reach the desired pH. Studies have not been carried out far enough to determine the best type of equipment suited for lime treatment of wastewater, however, the upflow clarifiers have been found satisfactory. Filtration is also practiced with sand or multi-media filters. Descriptions and results of the two pilot scale studies are presented. With filtration, 90% phosphorus removal was achieved at a pH of 9.5. Lime sludge must be concentrated for calcination. An accurate cost estimate of lime treatment is impossible without a long term operating experience. However, approximate costs are given. (Rayaan-Texas)
W72-03733

CHUTES SPEED COLLECTION OF 50,000 BANANA STEMS EACH WEEK.

Solid Wastes Management and Refuse Removal Journal, Vol 12, No 8, August 1967, p 34.

Descriptors: *Solid wastes, *Fruit crops, *Industrial wastes, Conveyance structures, *Chutes, Landfills, *Waste treatment.
Identifiers: *Bananas, Collection, Containers.

Geest Industries Ltd., a leading banana distributor, operates a banana ripening, packing and distribution facility in St. Helens, Lacanshire England. In designing the facility, particular notice was paid to facilities for collection and removal of an estimated 50,000 banana stems weekly. Since overhead conveyors are used to circulate the bananas through the ripening rooms, it was decided to install a collecting chute at some location on each of the conveyors. After the bananas are taken from the stems, the stems are placed on the conveyor again. At the stem chute, they are removed and placed in the chute which conveys them to one of 2 Dempster 10 yard universal containers owned by a private refuse hauling company, each holding approximately 4000 stems. The stems fill about 10 of the containers per week at present output. The containers are loaded on a Dempster truck and hauled to a tipping site. (Lowry-Texas)
W72-03734

ACTIVATED SLUDGE SOIL CONDITIONER UPS CROP RETURNS AT KIMBERLY-CLARK,
Michael D. Sullivan.
Pulp and Paper, Vol 44, No 4, April 1970, p 117-118, 2 fig.

Descriptors: *Corn (Field), *Pulp and paper industry, *Fertilizers, Industrial wastes, By-products, Sludge disposal, Sprinkler irrigation, Activated sludge, Centrifugation, Nutrients, Waste water treatment, California, *Water reuse.
Identifiers: *Soil conditioners, Sludge application.

Waste activated sludge from treatment of pulp and paper industry wastes was applied to several test plots to determine the practicality of using the sludge as fertilizer. A 28 acre test plot was set aside for the experiment, and it was immediately determined that the 1 1/2% dry solids content of sludge made the mixture too dilute and impractical to apply. Centrifuges were then used to concentrate the mixture to 14% dry solids content, and this mixture was applied by shovel and mixed with the soil with a roto-tiller. Corn plots were then treated as follows: (1) 1/6 acre control plot with no sludge; (2) 1/6 acre plot treated with steer manure; (3) 1/6 acre plot treated with 20 tons (dry solids basis) sludge per acre; (4) 1/6 acre plot treated with 40 tons (dry solids basis) sludge per acre. Corn stalks in the sludge treated versus control plots were fully twice as high and twice as productive, as well as being greener and healthier looking. In addition the treated soils retained moisture better. However, sludge does not match the nutrient assays of commercial fertilizers, which are readily available and more easily applied. Work is continuing on a wider number of soil types and crops. (Lowry-Texas)
W72-03735

THREE-STAGE PROGRAM AT ONTARIO PAPER TO ELIMINATE PULPING WASTE ORGANICS.
Ontario Paper Co. Ltd., Thorold (Ontario).

Pulp and Paper, Vol 44, No 1, January 1970, p 129-131, 2 fig.

Descriptors: *Pulp wastes, Pulp and paper industry, *Solid wastes, Dewatering, Filtration, Centrifugation, Evaporation, Incineration, Design criteria, Operation and maintenance, Industrial wastes, *Waste water treatment.
Identifiers: *Suspended solids.

A pulp mill constructed in 1912 has been successfully modified by the Ontario Paper Company to comply with present-day discharge requirements. A pollution abatement program has aimed at both reducing the volume of non-usable waste produced, and limiting the quantity of these wastes that are carried into the sewers. It was determined that the greatest portion of suspended solids in the plant's effluents was concentrated in only 4 million gallons (of the 24 mgd used by the plant). Separate sewers were constructed at another location due to lack of space at the plant site. Under-flow from the clarifier is concentrated from 3% solids to nearly 30% solids and trucked to a landfill. Ion exchange, and evaporation and incineration facilities are being planned and design is now underway. Total cost over the past 25 years has been $4,500,000 in research on development of by-products, resulting in 45 fewer tons of solids discharged daily. Research is now being directed to disposing of the solid wastes thus generated. (Lowry-Texas)
W72-03736

NEW WASTEWATER TREATMENT SYSTEM SHOWS HIGH FIBER RECOVERY RATES.
Owens-Illinois Inc., Big Island, Va.

Pulp and Paper, Vol 44, No 3, March 1970, p 131-132, 2 fig.

Descriptors: *Froth flotation, *Bubbles, *Pulp wastes, Pulp and paper industry, Industrial wastes, *Water reuse, Operation and maintenance, Pressure, Nozzles, Temperature, Hydrogen ion concentration, Water quality control, *Waste water treatment.
Identifiers: *Suspended solids, *Skimmers, Compressed air.

A European-designed Krofta Airfloat 36 flotation unit was installed at an integrated pulp and paper mill at Big Island, Virginia. The installation removes short wood fibers from 2.5 mgd of wastewater, mainly excess white water from the paper machines' seal pits, and from wet end broke thickeners. Feed consistency averaged 0.12% with a temperature of 115F and a pH of 8.2. The five steps of the airfloat operation are: (1) compressed air injection into pressurized wastewater through porous diffusers; (2) the pressurized liquid is discharged through several hundred nozzles into a 36 ft diameter flotation tank at a depth of 5 ft; (3) attachment of small air bubbles to the short wood fibers which then float to the top; (4) lifting of the fibrous froth from the water via a stainless steel scoop revolving at 10 rpm at the surface of the tank; and (5) discharge of the clarified water through the bottom of the tank to either the aerated lagoons or back to the mill for re-use. 80% of the wood fibers presented are recovered in usable form and recycled as a 2 to 3% slurry. Maintenance has been minimal. Further experimental work is underway to determine the effects of flocculants, air flow, temperature and operating variables on flotation efficiency, while the effects on BOD reduction, oxygen content, and secondary treatability of white water are also examined. (Lowry-Texas)
W72-03737

A CASE STUDY OF EFFLUENT TREATMENT BY CHANNEL AERATION PROPELLED AND OXYGENATED WITH EJECTORS,
Kimberly-Clark Corp., Neenah, Wis.
A. R. LeCompte, and M. G. Mandt.
Preprint, presented at Water Pollution Control Federation Conference, 44th, San Francisco, California Session 7, No 3, October 5, 1971, 14 p 2 tab, 4 ref.

Descriptors: *Oxygenation, *Aeration, Velocity, Turbulence, Mixing, Bubbles, Shear depth, Flow rates, Foaming, Dissolved oxygen, Sampling, Monitoring, Biochemical oxygen demand, Chemical oxygen demand, Pilot plants, Design criteria, *Waste water treatment.
Identifiers: *Jet ejector, *Pasveer ditch, Oxygen transfer.

Jet ejection for channel propulsion and aeration was studied on both a pilot scale and full scale basis. Influent to the pilot plant consisted of coated paper process effluent and a groundwood mill effluent. A 30-hour detention time in the pilot plant produced removals of BOD in excess of 90%, and removals of both suspended solids and BOD between 60 and 90% depending on the clarification system used. Full scale studies were then conducted to determine oxygenation capacities, velocity profiles, and mixing regimes. Oxygenation capacity, as measured by the sodium sulfite cobalt catalyst deoxygenation-reaeration method was shown to be in excess of 6 lbs of oxygen per hour of net mechanical-to-water input horsepower. Jet depth submergence, horsepower input, air and water flow rates, and jet angle were all varied to determine their affect on oxygenation capacity. Trade offs were made between depth and jet angle to compensate for velocity requirements and power input requirements. Jet aeration was shown to provide better mixing, velocity, and oxygenation capacity than conventional aerations, while eliminating fogging and freezing problems. Operating and design criteria were developed up through the multi-million gallon range from these studies. (Lowry-Texas)
W72-03738

BOD DETERMINATION FOR INDUSTRIAL WASTEWATERS,
Nebraska Univ., Lincoln. Engineering Research Center.
M. J. Hammer.
Water and Sewage Works, Vol 118, Ref No 1971, p R/104-R/108, 4 fig, 3 ref. FWQA supported.

Descriptors: *Biochemical oxygen demand, *Laboratory tests, *Industrial wastes, Municipal wastes, Dissolved oxygen, Bacteria, Protozoa, Activated sludge, Acclimatization, Nitrification, Sampling, *Waste water treatment.
Identifiers: Seeding.

A comprehensive plan for conducting BOD tests on industrial wastes is presented. Procedures are outlined regarding wastewater sample collection, wastewater sample preparation, seed preparation, BOD sample dilution and preparation, incubation and dissolved oxygen determinations, BOD calculations, and presentation of the BOD results. A case history of a pharmaceutical waste was presented to illustrate some of the difficulties involved. Industrial wastes present included sucrose and lactose sugar, acetone, ethanol, cellulose microcrystalline, chloroform, isopropyl alcohol, methyl chloroform, and silica gel. BOD versus time curves were prepared and presented. The effect of inhibiting substances was noted by observing the reaction rate constants. A 5-day carbonaceous BOD value of 700 mg/l was obtained, but it was noted that such values are accurate only to plus or minus 20%, and that care must be exercised in applying such results. (Lowry-Texas)
W72-03739

USE OF SOIL TO TREAT ANAEROBIC LAGOON EFFLUENT RENOVATION AS A FUNCTION OF DEPTH AND APPLICATION RATE,
Iowa State Univ., Ames. Dept of Agricultural Engineering.
J. K. Koelliker, and J. R. Miner.
Transactions of the American Society of Agricultural Engineers, Journal Paper No 69-460, 1970, p 369-499.

Descriptors: *Waste water treatment, *Farm wastes, *Irrigation, Soils, *Anaerobic conditions, Rates of application, Chemical oxygen demand, Phosphorus, Nitrogen, Denitrification, Adsorption, Biodegradation, Ion exchange, Effluents, *Water reuse.
Identifiers: *Anaerobic lagoons.

Anaerobic lagoons are one method of treating the manure from livestock operations. The effluent of these lagoons is not of sufficient quality to safely discharge it to receiving waters. A study has been conducted to determine the degree of renovation of anaerobic livestock lagoon effluent achieved by percolation through the soil. A four foot section of tile drained Clarion-Webster silty clay loam was irrigated with 13.9 to 30.5 inches of lagoon effluent and tests for COD, nitrogen and phosphorus were made at various depths. Active soils appear to offer great potential for treating anaerobic lagoon effluents. COD, phosphorus and nitrogen were reduced 95, 99, and 80 percent respectively in 3 months of operation. Treatment efficiency did not appear to be a function of loading rate. It is recommended that if nitrogen removal is the goal that a wet schedule should be followed and that the applied wastewater should contain some organic matter as a substrate for denitrifying bacteria. Once application to an area has begun, it should be continued for as long as possible to insure conversion of ammonia nitrogen to nitrate nitrogen so that maximum reduction of nitrogen can be achieved by denitrification. (Goessling-Texas)
W72-03740

INHIBITION OF ANAEROBIC DIGESTION OF SEWAGE SLUDGE BY CHLORINATED HYDROCARBONS,
Water Pollution Research Lab., Stevenage (England).
J. D. Swanwick, and M. Foulkes.
Journal of the Institute of Water Pollution Control, No 1, 1971, (Water Pollution Research Laboratory Reprint No 619), 13 p, 8 fig, 2 tab, 3 ref.

Descriptors: *Waste water treatment, *Anaerobic digestion, *Toxicity, Bacteria, Laboratory tests, Sludge treatment.
*Chlorinated hydrocarbons, Chloroform, 1-1-1-trichlorethane, Solids concentration.

Recent partial or complete failures of anaerobic digesters at several sewage treatment plants have been attributed to the presence of chlorinated hydrocarbons in the sludge. Preliminary tests indicated that some, particularly chloroform, were highly toxic in small concentrations. Laboratory tests in batch digesters confirmed that chloroform is extremely toxic to anaerobic digestion and 1,1,1,-trichlorethane has been found to be equally toxic in the lower concentration range but less so at higher concentrations. Solids content and the proportion of undigested solids in the digester, the level of bacterial activity, and the presence of other toxicants have been found to be important variables influencing inhibitory effects. Although batch digestion tests have been found to give reliable results, further work, now in progress in continuous digesters is required to fully substantiate the findings. (Goessling-Texas)
W72-03741

NONZOOLGLOEAL BACTERIA IN WASTE-WATER ZOOGLOEAS,
Rutgers Univ., New Brunswick, N.J. Dept. of Environmental Sciences.
Richard F. Unz, and Norman C. Dondero.
Water Research, Vol 4, 1970, p 575-579, 4 fig, 2 tab, 20 ref.

Descriptors: *Activated sludge, *Trickling filters, *Bacteria, Isolation, Slime, Separation techniques, Analytical techniques, Proteins, Sulfides, *Waste water treatment.
Identifiers: *Zoogloea, Micromanipulation, Amorphous zoogloea.

Branched and amorphous zoogloeas were collected from the surface of trickling filters receiv-

ing primarily domestic wastewaters. Branched zoogloeas were infrequently found in trickling filter slimes and the zoogloeas present in the return activated sludge of one wastewater treatment plant were only of the amorphous type. A micromanipulation technique was employed for the single-cell isolation of microorganisms from 51 washed activated sludge and trickling filter zoogloeas. Only 203 of the isilated organisms were successfully recovered as viable cultures. Amorphous zoogloeas were determined to be by far the larger portion of the biomass of trickling filters and activated sludge whereas branched zoogloeas were usually very scarce. Amorphous zoogloeas contain a variety of biochemically active bacteria, and most of the branched zoogloea examined contained a small number of biochemically active non-zooloeal bacteria. Therefore the role of branched zoogloeal bacteria was established as minimal. Further research is needed to elucidate the role of non zoogloeal bacteria in wastewater zoogloeas and to understand the mechanism of zoogloea formation. (Lowry-Texas)
W72-03743

A THEORY OF CONSTANT PRESSURE FILTRATION,
Sydney Univ., (Australia). Dept. of Soil Science.
D. E. Smiles.
Chemical Engineering Science, 1970, Vol 25, p 985-996, Pergamon Press, Great Britain, 8 fig, 21 ref.

Descriptors: *Waste water treatment, Sludge disposal, *Filtration, Darcy's Law, Analysis, Forecasting, Optimization.

Cake filtration is a common practice in laboratory as well as industrial practice. Analyses that predict the flow of the liquid in such liquid-solid systems are based on Darcy's Law. Initial reviews of this process conventionally considered the filtration process to be subject to steay state analysis. Two alternative but equivilent analysis of cake filtration are available. One is based on a space coordinate system and the other is based upon material coordinates. Both recognise that Darcy's Law describes flow of water relative to solid particles and not relative to fixed space and both take account of mass flow of the solid component. Using either of these treatments together with the measurable behavioral properties of the system to be filtered, one can calculate (a) the fluxes of water and of solid, (2) the cumulative amounts of water leaving the system and of solid within any distance from the filter membrane, and the distribution in space and time of water and solid. Simple manipulation permits a comparison of effects of different conditions. The analysis is based on behaviorial properties of the two component systems and these properties should be determined empirically. There is not at present sufficient information to justify the use 'in practice' of the relationships shown in some of the equations developed, particularly when the empirical determination of these values presents few problems. (Goessling-Texas)
W72-03744

G. N. TAKES GIANT IMPROVEMENT STEP WITH NEW MGO PLANT,
J. C. W. Evans.
Paper Trade Journal, Vol. 154, No. 15, April 13, 1970, p 50-53, 5 fig.

Descriptors: *Pollution abatement, *Pulp wastes, Pulp and paper industry, Biochemical oxygen demand, Magnesium, Sulphur compounds, Costs, Economic analysis, *Waste water treatment, Treatment facilities, *Water reuse.
Identifiers: *Sulphite pulping process, Magnesium bi-sulphite pulping process, *Chemical waste recovery.

Early in the last decade Great Northern began to explore modifications to its sulphite pulp mill in Millinocket, Maine which would improve the quality of the pulp and solve the pulping liquor pollution problem. In 1967, it was decided to switch from the sodium bi-sulphite pulping process to magnesium bi-sulphite and to install a $ 10 million chemical recovery system. By converting to the magnesium bi-sulphite process and the careful design for high chemical recovery, this plant has realized an 85% reduction in BOD in the mill effluent over the sulphite process previously used. The company states that the project will be self sustaining on operating and capital costs through the recovery of chemicals and steam generated over and above the requirement of the process. Peter S. Paine, Chairman of the Board stated that the primary purpose of the installation was pollution control and is a major step in fulfilling the company's committment to reduce pollution. (Goessling-Texas)
W72-03752

REVIEW OF STARCH PROBLEMS AS RELATED TO STREAM POLLUTION,
Western Michigan Univ., Kalamazoo. Dept. of Paper Technology.
W. J. Gillespie, C. A. Mazzola, and D. W. Marshall.
Paper Trade Journal, Vol. 154, No. 9, March 2, 1970, p 29-32, 6 fig, 16 ref.

Descriptors: *Waste water treatment, *Turbidity, Biochemical oxygen demand, Dissolved oxygen, Algae, Thermal stratification, Coagulation, Bentonite, Lime, *Pulp wastes, Teotiary treatment, Effluents.
Identifiers: *Starch removal, Starch substitution, Poyelectrolytes.

Although there are operating losses of starch during production, the primary adverse effect results from the repulping of starch bearing broke or waste paper. This excess starch, particularly oxidized starch, in the system adversely affects the paper making process and increases turbidity of the effluents that must be treated prior to discharge. Starch dispersions are difficult to coagulate with conventional flocculants, however, bentonite clays have been used successfully at dosages of 200 mg/l. Starch dispersed in the mill discharges exerts two dibilitating effects on the receiving stream, a high BOD and an increased turbidity which limits light penetration. Though starch substitution and process modifications offer considerable promise for elimination of starch induced dispersions, it is probable that universal application of such alternatives cannot be achieved. Secondary treatment does provide a mechanism for starch turbidity removal. However, its utilization for only the aesthetic improvement of waste discharge represents a costly approach in areas where effluent standards do not otherwise require it. The task that remains is for technology to devise a means of starch problem resolution in the primary clarifier. (Goessling-Texas)
W72-03753

THE HYDRASIEVE-A NEW SIMPLIFIED SOLIDS-LIQUID SEPARATOR,
Combustion Engineering Inc., Chicago, Ill.
M. E. Ginaven.
Paper Trade Journal, Vol. 54, No. 3, January 19, 1970, p 34-39, 9 fig.

Descriptors: Pulp and paper industry, *Slurries, Fibers, Energy equation, *Waste water treament, Biochemical oxygen demand, Efficiencies, Rates of application, *Separation techniques, *Pulp wastes, *Sieves.
Identifiers: *Thickening, Primary clarifers, Solid-liquid separation.

The Bauer Brothers Company developed the Hydrasieve to provide an answer to the problem of thickening pulp slurries from -3% to greater than 4% slurries that can be effectively handled by other thickeners. A number of devices were tested before a conventional side-hill screen using Marvel wire, a trinagular cross-section wire, was developed. This wire allows the effective and rapid draining of the liquids from the slurries without blinding. The slurry is fed to the screen from a headbox and an inclined plane which accelerates and thins the flow for dewatering. The surface liquid is drained from the slurry as it passes over the main portion of the screen. Near the base of the Hydrasieve, the slope is decreased, allowing gravity separation of more liquid. This development has been in successful operation in several paper mills since 1965. Additional applications of this development have proven successful. The Hydrasieve was installed in a flax washing line to thicken slurries and improve recovery of fibers. This screen completely eliminated the previous problems of blinding and poor thickening properties of conventional screens. The Hydrasieve has been used in place of a primary settling basin with an increase in efficiency and decrease in space. The Hydrasieve is a low cost, low maintenance and flexible device that can handle a variety of thickening problems. (Goessling-Texas)
W72-03754

WASTE-WATER RENOVATION,
Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
M. Pressman.
The Military Engineer, No. 409, September-October, 1970, p 313-315, 4 fig.

Descriptors: *Waste water treatment, *Water reuse, Coagulation, Flocculation, Chemical treatment, Reverse osmosis, Filtration, Sands, Activated carbon, *Treatment facilities.
Identifiers: *Portable treatment unit.

Water for drinking and other purposes is a vital supply item to military units in the field. Frequently units are not close to safe water supplies and potable water must be transported by vehicle and this can seriously tax the logistic support system. In late 1967, a project was initiated to develop an air-transportable treatment system for the renovation of wastewater from shower units, laundry units and kitchens. The system that emerged from a coordinated program of laboratory study, pilot plant testing and prototype testing included the following unit processes, equalization, chemical coagulation, sedimentation, filtration, demineralization, activated carbon adsorption and disinfection. The prototype unit consisted of three 3,000 gal and one 1,500 gal standard military collapsible tanks and two standard Air Force pallets. Components mounted on the first pallet include controls, raw-water pump, lime slurry feeder, chemical solution feeder, filter feed pump, and filtered-water transfer pump. The second pallet contains a tubular reverse osmosis demineralizer with 1,185 sq. ft. of membrane, a 2 ft. diameter carbon column with 8 cu. ft. of carbon, a solution feeder, pH meter/controller and a conductivity meter/controller. Total shipping weight is 14,000 pounds and only 16 manhours are required for assembly. The unit has been successfully tested with 120,000 gallons of synthetic wastewater. It is a flexible system in that the system can be adapted to treat various kinds of water to specified qualities. (Goessling-Texas)
W72-03755

CASE HISTORIES OF PLATING WASTE RECOVERY SYSTEMS,
Pfaudler Co., Rochester, N.Y.
J. M. Culotta, and W. F. Swanton.
Plating, Vol 57, March 1970, p 251-255, 5 fig, 7 ref.

Descriptors: *Distillation, *Effluents, *Evaporators, Waste water treatment, Hydrogen ion concentration, Chromium, Corrosion, Design criteria, Water reuse.
Identifiers: *Plating waste recovery systems, Dragout rinse, Batch-operated systems, *Chromium plating, Fluoborate, Vacuum pumps.

Present day concepts of plating techniques and systems have come about because of the milestones that were reached over the past twenty years. Evaporative recovery of plating wastes has advanced from manually operated batches, processed in jacket kettles, to completely automated, continuous systems incorporating processes for removal of impurities and recovery of water. Applications include a wide variety of plating and treatment baths including chromium, nickel, acid, and alkaline copper and various cyanides. From the beginning of plating operations, when simple batchwide-operated systems were used, it became apparent that reuse of the distillate for rinsing purposes was highly desirable. By reusing it, plating became a closed loop process with no waste effluent which during an upset or misoperation might be contaminated, and no introduction of impurities from raw water was made. This concept produced what is referred to as the 'Simple Closed Loop Evaporative Recovery System'. Over the years, several problems arose in the areas of corrosion and chemical recovery which led to some innovative changes in the overall system. Waste treatment also presented a problem in small towns, so separate recovery systems for each chemical and closed loop rinsing through the use of counter-current rinse tanks was employed on each line. Thus, plant water requirements were drastically reduced. Through these changes and many others the plating industry has been able to overcome the major problems that confronted it. (Biggs-Texas)
W72-03757

DEMINERALIZATION OF WASTEWATER BY THE TRANSPORT-DEPLETIC PROCESS,
Southern Research Inst., Birmingham, Ala.
Robert E. Lacey, and Everett L. Huffman.
Copy available from GPO Sup Doc as $0.65; microfiche from NTIS as PB-206 191, $0.95. Environmental Protection Agency, Final report, 17040 EUN, February 1971. 86 p, 9 tab, 9 fig, 5 ref. FWQA Contract Nos. 14-12-443 and 14-12-812.

Descriptors: *Desalination processes, *Transport depletion, *Waste water treatment, *Electrodialysis, Demineralization, Membrane processes, Sewage effluents, Municipal wastes, Cost analysis.

The transport-depletion process was investigated for demineralizing municipal secondary effluent. Wastewater containing 850 mg/l. total dissolved solids and having a turbidity of 1 to 10 JTU, was demineralized continuously for 500 hours in a pilot plant at a rate of 3800 gpd. Although regenerated-cellulose membranes were found to be satisfactory in regard to physical durability, the coulomb efficiencies attained with these membranes were only 0.14 to 0.28. The major problems encountered in demineralization of wastewaters by conventional electrodialysis, fouling and scaling, were, however, largely overcome by the use of a special anion-selective membrane and periodic flushing of the stack with sodium chloride solution. With the special anion-selective membrane, current densities up to three times the conventional limiting current density could be used without precipitation of pH-sensitive salts and coulomb efficiencies of 0.70 were obtained during the 500 hours of operation. Membrane fouling, which caused the electrical resistance of the demineralization stack to increase, was largely overcome by flushing the stack with a sodium chloride solution. This flushing technique should be useful for cleaning conventional electrodialysis stacks. Cost estimates for a 10 mgd plant indicated a demineralization cost of 25.7 cent/kgal for transport depletion compared to 27.8 cent/kgal for electrodialysis and required activated carbon pretreatment. The estimated cost for transport depletion is slightly lower because it does not require activated carbon pretreatment. (EPA abstract)
W72-03782

HEALTH ASPECTS OF LAND DISPOSAL OF MUNICIPAL WASTE-WATER EFFLUENTS,
National Research Council of Canada, Ottawa (Ontario). Div. of Biology.
S. K. Krishnaswami.
Can J Pub Health. 62 (1): 36-41. 1971.
Identifiers: Disposal, Effluents, Health, Land, Municipal, Reclamation, Waste.

The current trend from an agrarian to an increasingly urban society and its effects on the environment and, in particular, on the problem of the disposal of municipal wastewaters is discussed. The reclamation and reuse of wastewater is suggested. Examples of successful reclamation projects are given. Methods to overcome possible health hazards such as the presence in wastewaters of microorganisms, viruses, and chemical pollutants are discussed. The paper concludes with a set of guidelines outlining permissible uses for renovated wastewater and the quality requirements which must be met in particular situations--Copyright 1971, Biological Abstracts, Inc.
W72-03816

POLLUTION CONTROL IN STEELMAKING: FACT OR FICTION,
Rand Corp., Santa Monica, Calif.
For primary bibliographic entry see Field 05G.
W72-03856

CONVERTING ORGANIC WASTES TO OIL: A REPLENISHABLE ENERGY SOURCE,
Bureau of Mines, Pittsburgh, Pa. Pittsburgh Energy Research Center.
H. R. Appell, Y. C. Fu, S. Friedman, and P. M. Yavorsky.
Available from NTIS, Springfield, Va. 22151 as PB 203 669 $3.00 Paper copy. Report of Investigations 7560, 1971. 20 p, 3 fig, 10 tab.

Descriptors: *Cellulose, *Energy conversion, *Organic wastes, *Oil, Wood wastes, Sewage sludge, Lignins, Cities, Water pollution control, Energy transfer, Methodology, Pollution abatement, *Waste water treatment, Waste treatment.
Identifiers: *Bovine manure, Waste-energy conversion, Low-sulfur oil.

The report describes results of experimental work in converting cellulose, the chief constituent of organic solid wastes, to a low-sulfur oil. All types of cellulose waste, including urban refuse, agricultural wastes, sewage sludge, wood, lignin, and bovine manure have been converted to oil by reaction with carbon monoxide and water at temperatures of 350 to 400 deg C and pressure near 4,000 psig, and in the presence of various catalysts and solvents. Cellulose conversions of 90% (corresponding to oil yields of 40% to 50%) were obtained. Methodology of experimental procedures are described. Water used in the process serves as a vehicle (solvent) for the reaction. Urban wastes in the United States now total 400 million tons a year. Disposal of wastes pose environmental problems of increasing magnitude, particularly in the water cycle and the air. A significant part of the energy demand can be obtained on a renewable basis by converting nearly every kind of organic solid waste to low-sulfur oil and at the same time greatly reduce air and water pollution. (Lang-USGS)
W72-03874

EFFECT OF DETERGENTS ON THE DECONTAMINATION OF RADIOACTIVE WASTE-WATER BY PRECIPITATION AND COAGULATION,
Australian Atomic Energy Commission Research Establishment, Lucas Heights.
C. R. Frost.
Journal of the American Water Works Association, Vol 54, No 9, p 1082-1090, September 1962. 3 fig, 2 tab, 9 ref.

Descriptors: *Waste water treatment, *Detergents, *Radioactive wastes, Hydrogen ion concentration, Phosphates, Coagulation, Sedimentation.
Identifiers: Sludge blanket.

The effects of detergents on the decontamination of radioactive wastewater were determined in actual plant operation. Lisapol at 100 ppm will not effect the decontamination in sludge blanket clarifiers at pH greater than 10.1. Turco 4182A at 100 ppm will cause trouble although floc stabilization can be mitigated at higher pH. Calgon at 25 ppm is not detrimental to decontamination at pH greater than 11.4, but 42 ppm/calgon makes control difficult. This concentration also complexes uranyl ions and other radioactive ions. EDTA at 16 ppm does not affect decontamination, but owing to floc stabilization, 28 ppm makes clarifier operation difficult and reduces effectiveness. Only Turco 4182A reduced decontamination to below 80%. (Bean-AWWA)
W72-03961

SIX MONTHS EXPERIENCE WITH A PRESSURE SEWER SYSTEM DEMONSTRATION,
New York State Dept. of Environmental Conservation, Albany. Environmental Quality Research and Development Unit.
Italo Carcich, Leo J. Hetling, and R. Paul Farrell.
Technical Paper No. 4, April 1971. 46 p, 24 fig, 17 ref.

Descriptors: *Sewerage, *Pressure conduits, *Sewers, *Sewage disposal, *Pump testing, Waste water disposal, Prototype tests, Sanitary engineering, New York.
Identifiers: *Pressure sewer system, Pump-grinder.

A general description is presented of a combination sewage grinder-pump unit presently under test in Albany, New York. The unit was developed by the General Electric Company Re-entry and Environmental Systems Division in cooperation with the American Society of Civil Engineers. The grinder-pump unit has application in situations where gravity-flow sewer systems are not feasible. This would be the case for a building having plumbing fixture drains located below the elevation of the lowest possible gravity sewer connection. The grinding component consists of a rotating wheel carrying two hammers inside a fixed stationary cutting ring. The unit is designed to grind sewage and foreign objects that may accidentally enter the unit with sewage flow. The pump is designed to pump between 11 and 15 gpm over a range of heads from zero to 35 psig. Installations were made in basements of 12 townhouses in Albany for the purpose of demonstrating the operation of the unit. Six operating parameters are monitored at 15-minute intervals by a remote system using telephone wires. All data are recorded on paper tape and fed into a computer for analysis of the data. (Poertner)
W72-03962

EFFECTIVE GRAIN SIZE AND UNIFORMITY COEFFICIENT'S ROLE IN PERFORMANCE OF INTERMITTENT SAND FILTERS,
New York State Dept. of Environmental Conservation, Albany. Environmental Quality Research and Development Unit.
Thomas M. Allen.
Technical Paper No. 9, June 1971. 65 p, 8 fig, 4 tab, 12 ref.

Descriptors: *Uniformity coefficient, *Particle size, *Waste water treatment, *Sewage treatment, *Sanitary engineering, Filters, Materials testing, Filtration.
Identifiers: *Effective grain size, *Intermittent sand filters, Filter media, Grain size.

Regulatory officials, design engineers and contractors have reported difficulties in obtaining sand for intermittent sand filters which is acceptable under the recommendations of the 'Ten State Standards

for Sewage Works'. This project compared the performance of intermittent sand filters comprised of sand acceptable under the recommendation of the above named publication with that of filters comprised of various blends of concrete fine aggregate as specified by the American Society for Testing and Materials (ASTM). Concrete sand (fine aggregate) was selected for comparison with the recommended filter sand because it is more readily available and is significantly lower in cost. Seven (7) filters, each having a surface area of 2.67 sq feet (0.255 sq meters) were dosed twice a day at a rate of 3 gallons/sq feet/day (0.118 cu meter/sq meter/day) with a domestic waste septic tank effluent. The parameters used to judge the performance of the filters were BOD5, COD, Coliform Group, Turbidity, and cleaning cycles. It was concluded that: (1) the effective grain size range can be expanded to include the finer ASTM sands; (2) the uniformity coefficient is not as critical a parameter as is effective grain size; and (3) maintenance of intermittent sand filters employing the finer ASTM concrete sand would not be unduly difficult or time consuming. (Poertner)
W72-03963

CHEMICAL-PHYSICAL TREATMENT FOR WATERFORD, N.Y., PROGRESS REPORT 1,
New York State Dept. of Environmental Conservation, Albany. Environmental Quality Research and Development Unit.
T. J. Toffiemire, and Leo J. Hetling.
Technical Paper No. 10, August 1971. 157 p, 47 fig, 35 tab, 29 ref.

Descriptors: *Sewage treatment, *Waste water treatment, *Chemical precipitation, *Coagulation, Industrial water, Water supply, Feasibility studies, Technical feasibility, Pilot plants, New York, Water reuse.
Identifiers: *Chemical-physical treatment, *Low-line process, Waterford (N.Y.).

The Research and Development Unit of the New York State Department of Environmental Conservation undertook an extensive program of research and development in the area of direct chemical-physical treatment of raw wastewater. Waterford, New York was selected as the study site. The over-all objectives of the research program were as follows: determine design feasibility and gather cost data for chemical-physical systems by literature review, laboratory experiments and pilot plant operations; promote knowledge of chemical-physical wastewater treatment processes; demonstrate the workability of a full-scale 2.25 MGD chemical-physical wastewater treatment plant; and explore the potential for reuse of the effluent as industrial process water. The 7000 gpd pilot employing the low lime process, followed by granular activated carbon, nitrification and sand filtration achieved a colorless effluent with a turbidity of 5-10 JTU, no hydrogen sulfide, very little biodegradable organic matter and very few bacteria. It was thought that this effluent was suitable for paper mill reuse. High molecular weight anionic polymers caused increased settling velocity of the solids in the wastewater, but feeding of polymer in the proposed full scale plant appeared economical only at periods of peak flow. (Poertner)
W72-03964

URBAN WASTEWATER RECOVERY: CITY OF LOS ANGELES,
Los Angeles Bureau of Sanitation, Calif.; and Los Angeles Dept. of Water and Power, Calif.
Robert D. Bargman, George W. Adrian, and William F. Garber.
Chemical Engineering Progress, Vol. 64, No. 90, pp 216-224, 1968.

Descriptors: *Water reuse, *Waste water treatment, *Water treatment, *Reclaimed water, Industrial water, Potable water, Water spreading, Recirculated water, Sewage treatment, Tertiary treatment, Conservation, Water resources development, Water supply, California.
Identifiers: *Los Angeles (Calif), Hyperion Treatment Plant.

The City of Los Angeles made extensive analyses of wastewater quality, and investigations of water quality requirements for both industrial use and domestic reuse of wastewater. The study concerned the wastewater quality from a multizoned residential, commercial, and industrial area, where moderate industrial waste controls are enforced. The study showed the wastewater to be suitable for many uses if adequate treatment were provided and showed that the treatment could be provided at costs lower than or commensurate with the cost of imported water. Los Angeles is proceeding with wastewater recovery plans. Design of an advanced treatment plant in the middle reaches of San Fernando Valley and has been authorized by the Board of Public Works. This will provide a source of water for spreading basins currently only used a portion of the year in the San Fernando Valley. Initial design is for 40 million gal./day. Los Angeles currently produces 100 million gal./day of a good quality activated sludge effluent at the Hyperion Treatment Plant. Use of this recovered water for such purposes as oil refinery process water is currently under study. Initial results indicate that the use of the recovered water for this purpose will be satisfactory and will extend the available potable water supply accordingly. (Poertner)
W72-03968

SEWERAGE AND SEWAGE TREATMENT FACILITIES, COST ESTIMATING,
Washington State Dept. of Ecology, Olympia. Office of Planning and Program Development.
Charles J. Carelli.
July 1971. 39 p, 20 fig, 7 tab, 18 ref.

Descriptors: *Cost comparisons, *Waste water treatment, *Sewage treatment, *Sewerage, *Estimated costs, Capital costs, Operating costs, Treatment facilities, Sewers, Pumping plants, Trickling filters, Activated sludge, Electrodialysis.
Identifiers: *Advanced waste water treatment, *Waste water treatment costs, *Sewage disposal costs.

Cost versus capacity is presented in millions of gallons per day. This eliminates the need to estimate BOD loadings that will occur 30 years in the future. The plan this document was prepared for is designed to be updated every five years. After that time it may be shown that cost estimating should consider organic loading along with hydraulic loading. Should that be the case, a refinement of this document will be undertaken. Costs of construction of sewers and pumping stations are given in two ways: (1) a lump-sum figure on a dollar-per-acre basis, and (2) as an estimate of the in-place pipe cost as a function of depth of sewer and pipe-size. Sanitary sewer costs for various densities of development are tabulated (based on 120 gallons per capita/day). Costs of sewer pipe and the capital costs of sewage pumping stations are given. The latter vary greatly with the building design, the location of the facility, and the total dynamic head required. The capital costs and operating costs of secondary treatment high-rate trickling filter plants and secondary treatment activated sludge plants are given. Costs for advanced waste water treatment are given including: microscreening, granular carbon adsorbtion, electrodialysis, ammonia stripping, and various lime application processes. (Poertner)
W72-03969

DETROIT AIMS FOR SAVINGS WITH PURE OXYGEN AERATION,
Detroit Metro Water Dept., Mich.
G. Remus, D. Suhre, and G. Hubbell.
Paper presented at the Annual Conference, Water Pollution Control Federation, San Francisco, October 3-8, 1971. 16 p, 16 fig.

Descriptors: *Oxygenation, *Aeration, *Sewage treatment, *Waste water treatment, *Activated sludge, Michigan, Lake Erie, Water pollution control, Treatment facilities, Cost-benefit analysis, Biochemical oxygen demand, Bacteria, Aerobic treatment, Sanitary engineering, Sludge treatment.
Identifiers: *Detroit (Mich), Pure oxygen aeration.

The Detroit Metro Water Department is presently constructing $220 million of water pollution control works, and the City plans $193 million more in 1972. An additional $400 million of capital expenditures is planned by the end of 1979. Sewage disposal of the Detroit Metropolitan area is handled by a single interceptor system and a single treatment plant. In meeting commitments to provide sewage disposal service for the entire metropolitan area, with minimum land requirements and without demolishing usable residences in the area, studies were made of means of optimizing bacterial action by using pure oxygen aeration to support the activated sludge process. In February 1971, construction began on a two-tank aeration module that will consist of one tank of 150 mgd capacity on the deep tank, high rate, air aerated process, and a 300 mgd tank on the oxygenated activated sludge process. Operation is scheduled for February 1973. An additional 600 mgd oxygenation facility is planned to be put into operation in 1976. All in all, as compared to conventional activated sludge, Detroit is aiming for savings far in excess of the $2.50/mil gal expected to be realized with the oxygenated activated sludge. Early estimates are that on a plant-wide basis, overall operating and capital costs will have been trimmed by $21.35/mil gal through innovative design features. (Poertner)
W72-03972

POLLUTION CONTROL PROGRAM FOR THE DETROIT REGIONAL WATERSHED.
Detroit Dept. of Water Service, Mich.

September 1966. 42 p, 3 fig, 4 tab.

Descriptors: *Planning, *Water resources development, *Administration, *Future planning (Projected), *Water pollution abatement, *Lake Erie, Cities, Urbanization, Michigan, Waste water treatment, Sewage disposal, Sewerage, Treatment facilities, Investment, Sanitary engineering, Programs, Water pollution control.
Identifiers: *Detroit (Mich), Regional waste water disposal.

The Water Pollution Control Program adopted by the Detroit Board of Water Commissioners in 1966, is explained. The program calls for capital expenditures of $327 million between 1966 and 1975, and $595 million in the period 1976-2000. The program is designed to provide the orderly and effective growth of water pollution control facilities and community waste collection systems. Major objectives are: (1) systematic and orderly development of a single pollution control system for the Detroit Regional watershed; (2) construction of an area-wide wastewater interceptor system; (3) installation and operation of facilities for advanced wastewater treatment; (4) further reduction of stormwater overflows; (5) acceleration of industrial wastewater control on a cooperative government-industry basis; (6) improved methods of waste disposal for pleasure boats and freighters; (7) regulation of water levels in the Lake St. Clair-Detroit River-Lake Erie complex to aid in stream and shoreline beautification; (8) tighter control of lake and river dredging and landfill practices; (9) international assurance that the Canadian communities will take equivalent action to enhance the water quality of the Great Lakes; and (10) continuation of a broad and sound financing base (founded upon user charges) to assure uninterrupted progress. Acceleration is possible through use of Federal and State grants. Equipment for the removal of phosphates is being included in the construction and accompanying processes studied, in an attempt to restore the quality of Lake Erie. Though the major emphasis in the next several years will be on advanced treatment, massive programs are also planned for regional interceptors, sewers, and overflow controls. (Poertner)

W72-03973

ANNUAL REPORT, 1969-1970.
Sacramento City Div. of Water and Sewers, Calif.

October 15, 1970. 58 p, 36 fig, 29 tab.

Descriptors: *Statistics, *Planning, *Municipal water, *Operating costs, *Administration, *Municipal wastes, Water supply, Waste water disposal, Sewage treatment, Water quality control, Urbanization, Cities, California.
Identifiers: *Sacramento (Calif), Annual report.

This annual report marks the beginning of a new era for the Sacramento Division of Water and Sewers in that emphasis has shifted from meeting increasing water needs to that of improving the environment by upgrading waste treatment facilities. Although no major expansion of water treatment facilities will be required for the next five years, substantial expenditures will be made during this period to conform to the master plan of water system development. The most important facility to be constructed during the coming year will be the Florin Reservoir and Pumping Station at an estimated cost of $3,000,000. This station, powered by natural gas engine-driven pumps, will provide continuity of operation in the event of power failures at the main water treatment plants. Other planned improvements include large water transmission mains and purchase of sites for the future Freeport Water Plant and Laguna Reservoir. Phase I construction of secondary waste water facilities is about 70% complete. It is anticipated Phase II construction, scheduled following about one year of pilot plant study in conjunction with operation of Phase I facilities, will result in reducing the City's waste water pollution of the Sacramento River from 30% to less than 10%. It will be necessary to substantially increase sewer rates to offset added operational costs of these new facilities and maintain the bond debt covenants. If the Sewer Division is to remain as a self-supporting entity, it may be safely predicted that sewer service charges will eventually exceed water service charges due to more sophisticated and expensive treatment required to meet river discharge standards. (Poertner)
W72-03977

BACTERIAL REDUCTIONS IN THE CHLORINATION OF SEWAGE, REPORT NO. 2, LACONIA SEWAGE TREATMENT PLANT EFFLUENT QUALITY RECORD.
New Hampshire Water Pollution Commission, Concord.

February 1955, Revised 1968. 74 p, 14 tab.

Descriptors: *Chlorination, *Sewage bacteria, *Sewage treatment, *Waste water treatment, New Hampshire, Treatment facilities, Chemical degradation, Aquatic microbiology.
Identifiers: *Bacterial reductions, *Chlorine dosage, Chlorine residual, Detention time.

This study was initiated primarily to determine a general chlorine dose level at which an adopted chlorination schedule should be maintained to produce an effluent of acceptable bacterial quality from the Laconia sewage treatment plant. The data are recorded in detail and assembled for easy reference and future use. Along with the plant effluent study, a parallel study of very limited scope on the efficiency of chlorination was run on a laboratory scale. Some effort was also made in the laboratory to indicate the material difference, if any exists, between the bacterial quality of settled sewage which has been chlorinated prior to settling (an arbitrary 2-hour settling period allowed) and that which has been chlorinated after settling and allowed a contact period of 15 minutes. It appears that the capital costs of providing detention periods much in excess of 15 minutes are often not justified by the increased kills provided. Where higher kills are necessary during certain seasons, a seasonal increase in the chlorine dose is indicated rather than additional detention period. It is recommended that the daily chlorine dose at the Laconia Plant never be allowed to drop below 14 ppm, and that the chlorine residual (O.T. method) of the settling tank effluent never be allowed to drop below 1.0 ppm. (Poertner)
W72-03981

POLLUTION ABATEMENT BY FIBER MODIFICATION.
Washington Univ., Seattle. Inst. of Forest Products.

Copy available from GPO Sup Doc as SOD EP2.10112040 EFC 01/71, $0.65; microfiche from NTIS as PB-206 219, $0.95. Environmental Protection Agency Water Pollution Control Research Series No 12040 EFC, January 1971. 54 p, 25 fig, 14 tab, 263 ref. Project No. 12040 EFC.

Descriptors: Pulp and paper industry, Water pollution treatment, Pollution abatement, Fibers (Plant), Ligins, Cellulose, Waste water treatment, Phenols, Chemical wastes, Industrial wastes, Organic wastes, Pulp wastes, Sulfite liquors.
Identifiers: Lignosulfonates, Dye chemistry, Amines, Mercaptans.

Laboratory studies were conducted to determine if the collection of pollutants from water using fibers was a feasible concept. Any cellulosic or lignocellulosic fibers can be reacted with di- or trihalogeno-s-triazines in simple aqueous conditions so that about 10% by weight of reactive sites can be built into the fiber. The modified fibers can be regarded as polychloro-s-triazinylated fibers in which each s-triazine ring contains approximately one or two reactive chlorine atoms. The extent of reaction is generally determined by the stereotopochemistry of the fiber and in particular by its lignin content and its microporous structure. Chloro-s-triazines are capable of reacting in aqueous solutions with amines, mercaptans and phenols, typical of those present in pulping wastes and bleach plant effluent. The efficiency of this system is obviously increased as the size of the pollutant removed per reactive fiber size is increased. Methods to increase the size of lignosulfonates by condensation have therefore been developed. Two new methods for the collection of pollutants by fibers based on oxidative grafting and physical entrapment by hydrodynamic volume changes have also been discovered and a procedure for the characterization of copolymer compositions by surface tension has been established. (EPA abstract)
W72-03982

ECONOMICS OF WATER USE AND WASTE DISPOSAL IN DELAWARE VEGETABLE PROCESSING,
Delaware Univ., Newark. Dept. of Agricultural Economics.
T. H. Stevens, and G. L. Cole.
Agricultural Experiment Station, Bulletin 380, July, 1969. 19 p, 6 fig, 20 tab, 15 ref. OWRR B-003-DEL (4).

Descriptors: *Industrial plants, *Industrial water, *Water requirements, Waste water (Pollution), Waste water disposal, Operating costs, Costs, Delaware, Water pollution sources.
Identifiers: *Vegetable processing.

Six vegetable processing plants in Delaware were studied in order to make inferences about (1) the water requirements for the processing of vegetable products, (2) the quantity and strength of waste water from the processing, (3) the factors affecting the water requirements and the waste water strength, and (4) the costs of intake water, waste disposal, and waste treatment. The vegetables processed during the period studied were green beans (four plants), peas (three plants), lima beans (three plants), asparagus (two plants), and tomato products (one plant). The study procedure included measuring the quantity of waste water at one-half hour intervals and collecting composite waste samples daily. Cost data were gathered from plant records. Water requirements and the quantity and strength of waste water were found to differ widely between plants producing the same product and between products. Increases in plant operational rates were found to increase the efficiency of water utilization and decrease the quantity of waste water per unit of output. Cost data indicated that intake water at the six plants ranged from 4-14 mills per 303 case, while waste disposal costs ranged from 22-56 mills per 303 case at plants treating more than 75% of their waste water. (Settle-Wisconsin)
W72-03996

ACTIVATED SLUDGE DEWATERING: BIOLOGICAL CONDITIONING FOR IMPROVED FILTERABILITY,
Lamar Univ., Beaumont, Tex.
D. G. Parker, C. W. Randall, and P. H. King.
Preprint, presented at 44th Annual Conference of Water Pollution Control Federation, Session 9, No 4, October 5, 1971. 30 p, 15 fig, 18 ref.

Descriptors: *Waste water treatment, *Sludge disposal, Filtration, Microorganisms, Aeration, Anaerobic conditions, Chlorination, Zeta potential, Flocculation, Activated sludge, Biological treatment, Sewage treatment, *Dewatering.
Identifiers: Van der Waal's forces, Polysaccharides, Polymers.

Handling and disposing of sewage sludge is a major expense in sewage treatment. Although sludge volume is less than 1% of the plant influent, the cost of handling and disposing of waste sludge may exceed 65% of the total capital and operating cost. An investigation has been completed to evaluate the effects of commonly used sludge handling procedures on the subsequent filterability of activated sludge, to determine the chemical and biological properties of sludge that affect filterability, and to define handling procedures that are destructive to filterability. Van der Waal's forces and zeta potential did not appear to have a profound affect on sludge filterability. The presence of biologically produced polymers was not determined directly; however, the increase in filtrate carbohydrate indicated that polysaccharides were being excreted from bacteria and that these saccharides were ending up in the filtrate. The mechanism of filtration improvement appears to have been biologically induced flocculation. When biological activity was disrupted, the sludge filterability rapidly degenerated, and when biological activity was inhibited, filterability either stabilized or became progressively worse. Filterability can be adversely affected by anaerobic storage, excessive mixing, chlorination, and rapid temperature changes. Filtration properties can be restored or improved by aeration for extended periods of time. The biological organisms must be aerobically maintained in the endogenous phase and be active and intact when subjected to dewatering. (Goessling-Texas)
W72-04051

WATER CONTAMINATION BY CERTAIN HEAVY METALS,
General Electric Co., Schenectedy, N.Y.
For primary bibliographic entry see Field 05C.
W72-04052

TURBINE AERATION AS A MODIFICATION OF AN EXISTING ACTIVATED SLUDGE PROCESS,
Greater Peoria Sanitary and Sewage Disposal District, Ill.
L. N. Hughes, and J. F. Meister.
Preprint, presented at 44th Annual Conference of Water Pollution Control Federation, Session 8, No 2, October 5, 1971. 26 p, 13 fig, 9 tab, 26 ref.

Descriptors: *Waste water treatment, *Activated sludge, *Aeration, *Turbines, Bubbles, Efficien-

cy, Dissolved oxygen, Biochemical oxygen demand, Sewage effluents, Mixing.
Identifiers: Oxygen transfer efficiency, *Turbine aeration.

The district's treatment plant was designed in 1928 as a conventional activated sludge process to treat 30 MGD. Over the years it has been modified and adapted until today it treats 70 MGD as a high rate process. The aeration system has been a source of constant concern and trouble. As a result, an experiment has been conducted to test submerged aerators to alleviate some aeration problems. Two 40 hp submerged turbine aeration units were installed in each of two 189 foot long aeration tanks. These units were placed 20 and 40 feet from the head end of each tank and the downstream end of the tanks received air from the conventional porous plates originally installed in the tanks. Two years of operation have proved the worth of this concept. Effluent quality has been consistently better than that of the diffused air system employed in parallel tanks. Food to biomass ratios averaged 1.02 and frequently exceeded 2.6 without degradation of effluent quality. Contrary to analysis, sludge production was less than one pound per pound BOD removed. The turbines required less air to effect equal or greater BOD and suspended solids removal than the diffused air system. Maintenance on the turbines was negligible and operating costs were about half of those associated with diffused air. High oxygen transfer efficiency and improved mixing are responsible for this high treatment efficiency. The results of this experiment indicate that submerged turbine aerators might improve treatment efficiency, increase plant capacity and save money all at the same time. (Goessling-Texas)
W72-04053

KINETICS OF FERMENTATION PROCESSES,
Takeda Chemical Industries Ltd., Osaka (Japan).
T. Kono, and T. Asai.
Biotechnology and Bioengineering, Vol XI, 1969, p 293-321. 21 fig, 9 ref.

Descriptors: *Fermentation, *Microorganisms, Growth rates, Productivity, Laboratory tests, *Kinetics, *Waste water treatment.
Identifiers: *Kinetic theory.

Fermentation kinetics has been studied by many researchers in recent years. However, the kinetic theory which can be applied mathematically to various types of fermentation processes has not been presented. Accordingly, fermentation studies have been made and a general equation of production rate has been presented for the first time. This theory is applied to the microbial cell growth which was previously reported by the authors. Equations for the product concentration in fermentation time courses were derived by developing mathematically the general equation of production rate. The theory developed in this fashion was used to analyze kinetically some examples of fermentations. The theory assisted in clarifying some of the characteristics of the processes. The calculated values of cell concentration and product concentration based on this theory were in good agreement with the observed values. (Goessling-Texas)
W72-04054

VOLATILE FATTY ACIDS AND INHIBITION OF ESCHERICHIA COLI GROWTH BY RUMEN FLUID,
Illinois Univ., Urbana. Dept. of Dairy Science; and Illinois Univ., Urbana. Dept. of Microbiology.
M. J. Wolin.
Applied Microbiology, Vol 17, No 1, January 1969, p 83-87, 1 fig, 7 tab, 5 ref.

Descriptors: *Escherichia coli, *Growth rates, *Inhibition, Ruminants, Nutrient requirements, Hydrogen ion concentration, Laboratory tests.
Identifiers: *Rumen fluid, *Volatile fatty acids.

It was reported previously that E. coli K-12 could not grow in an in vitro continuous culture of mixed rumen microorganisms. Intuition pointed to the volatile fatty acids (VFA) as the growth inhibition agents and a study has been conducted to determine if this is so. Concentrations of volatile fatty acids normally found in the rumen fluid inhibited growth of E. coli in Antibiotic Medium 3. Acetic, propionic, and butyric acids each produced growth inhibition which was markedly pH dependent. Little growth inhibition was observed at pH 7.0, and inhibition increased with decreasing pH. A combination of 60 micro-mole of acetate, 20 micromoles of propionate, and 15 micro-moles of butyrate per ml gave 96, 69, and 2% inhibition at pH 6.0, 6.5 and 7.0 respectively. Rumen fluid (50%) gave 89 and 48% inhibition at pH 6.0, and 6.5 respectively, and growth stimulation (22%) at pH 7.0. Rumen fluid inhibitory activity was heat stable, was not precipitated by 63% ethylalcohol, and was lost by dialysis and by treatment with anion-exchange resins but not with cation-exchange resins. These results are consistent with the idea that VFA are the inhibitory substances in rumen fluid. Previous results which indicated that rumen fluid VFA did not inhibit E. coli growth were due to lack of careful control of the final pH of the growth medium. The E. coli strain used did not grow in rumen fluid alone at pH 7.0. (Goessling-Texas)
W72-04055

AERATED LAGOONS-A REPORT ON THE STATE OF THE ART,
Virginia Polytechnic Inst., Blacksburg.
Eric H. Bartsch, and Clifford W. Randall.
Journal Water Pollution Control Federation, Vol 43, No 4, April 1971, p 699-708. 6 fig, 1 tab, 7 ref.

Descriptors: *Lagoons, *Waste water treatment, *Temperature, Mixing, *Oxidation lagoons, Biochemical oxygen demand, Dissolved oxygen, Operation and maintenance, Electric power costs, *Reviews.
Identifiers: *Aerated lagoons, *Reaction rates, *Suspended solids.

A full-scale aerated lagoon was monitored to provide considerable operational data in order to evaluate critically the temperature prediction and effects formulation. The lagoon studied treated 0.7 mgd of textile-finishing plant wastewater. The efficiency of the aerated lagoon system was strongly temperature dependent below 58 deg F, and strongly temperature independent above 58 deg F. Present theory did not predict aerated lagoon reaction rates accurately, particularly for temperatures less than 12 deg C. However, the Eckenfelder formula accurately predicted lagoon temperature from air and waste temperatures if thermal equilibrium between the lagoon and the atmosphere had been reached. Further research indicated that although aerated lagoons provide good quality effluent at low power input and a savings in land area most of the year, wintertime operation becomes marginal due to slower reaction rates and increased residence times, with subsequent increased per unit power costs. Additional information is needed concerning the various operating variables to permit rational decisions to be made. (Lowry-Texas)
W72-04056

INTRACELLULAR PH,
North Carolina Univ., Chapel Hill. Dental Research Center.
W. J. Waddell, and R. G. Bates.
Bacteriological Reviews, Vol 49, No 2, April 1969, p 285-329. 4 fig, 19 tab, 149 ref.

Descriptors: Measurement, Analytical techniques, Data collections, *Hydrogen ion concentration, *Reviews, *Bibliographies.
Identifiers: *Intracellular pH, Definition, *Literature review.

A review of intracellular pH has been undertaken to (1) survey the literature published since 1956 (the time of the last review) and (2) clarify the definition of intracellular pH, deal with its usefulness and importance and discuss experimental methods and treatment of data. The calculation of overall intracellular pH by the carbon dioxide or DMO method is apparently valid; Indications are that most cells have an intracellular pH of about 7 under normal conditions. Certain metabolic functions can have a greater effect on intracellular pH or extracellular pH without appreciable effect on the pH of the other. The enthrocyte may be permeable to H+, K+, Cl-, HCO3-, and DMO- ions; these ions appear to be in equilibrium across the cell membranes. In other cells the mechanism of control of intracellular pH is unknown, however, active transport of H+ is most unlikely because of the ready and constant availability of passive carrier molecules; Calculations indicate that the concentrations of sodium, potassium and hydrogen ions in the intracellular water relative to their concentrations in the extracellular water increase or decrease simultaneously; It would be highly desirable to have a weak base that could be used for the estimation of intracellular pH, but so far a suitable base has not been reported. (Goessling-Texas)
W72-04057

WATER: PURIFICATION AND DECONTAMINATION, A DDC BIBLIOGRAPHY.
Defense Documentation Center, Alexandria, Va.

Available from the National Technical Information Service as AD-725 610, $3.00 in paper copy, $0.95 in microfiche. June 1971. 76 p, 76 ref.

Descriptors: *Bibliographies, *Waste water treatment, *Water purification, *Water pollution treatment, Ion exchange, Filtration, Distillation, Disinfection, Coagulation.
Identifiers: Remote areas, Closed ecological systems.

A compilation of 76 references selected from abstracts received at the Defense Documentation Center between January, 1953 and December, 1970. Each report is identified by title, author, organization, search control number and where applicable, report number and project. Most of these reports are represented by abstracts including descriptors and identifiers. The reports analyze the purification, distillation and decontamination of water. The emphasis of the bibliography is on water treatment under unusual circumstances, in submarines, in artic regions, in tropical regions and in spacecraft. Recycling of water in closed ecological systems using ion exchange, filtration, disinfecting agents and coagulation to produce potable water is included. Several articles by Russian authors on these subjects have been translated and are included. Documents are indexed by corporate author, monitoring agency and subject. (Goessling-Texas)
W72-04058

REUSE AND SUBSURFACE INJECTION OF MUNICIPAL SEWAGE EFFLUENT: TWO CASE HISTORIES,
Bureau of Mines, Bartlesville, Okla. Bartlesville Energy Research Center.
Eric C. Donaldson, and Abdo F. Bayazeed.
U. S. Bureau of Mines Information Circular 8522, 1971. 20 p, 8 fig, 2 tab, 11 ref.

Descriptors: *Water reuse, *Water quality control, *Deep-well pumping, Industrial wastes, Municipal wastes, Activated sludge, Coagulation, Sedimentation, Neutralization, Filtration, Ion exchange, Oxidation lagoons, *Waste water treatment.
Identifiers: *Subsurface injection, *Suspended solids.

A chemical-industrial complex in an arid region depends upon municipal sewage for its water

supply. Six mgd of sewage are subjected to screening, primary clarification, activated sludge treatment, lagooning, cold lime treatment, filtration, and ion exchange. Cost of treatment is approximately 50 cents/1000 gallons, not excessive for the degree of purity which is produced. Waste liquids from the industries are neutralized, subjected to coagulation and sedimentation, and passed through leaf filters for suspended solids removal before being sold or disposed of by deep-well injection at an average rate of 1.2 mgd. A second example is that of a city of 3,000 population whose effluent from sewage treatment lagoons is subjected to subsurface disposal to avoid contamination of surface waters. (Lowry-Texas)
W72-04061

CALCULATION OF THE MEAN THROUGHPUT OF VACUUM DRUM FILTERS, ALLOWING FOR PLUGGING OF THE FILTER CLOTH,
M. Kh. Kuchinskii.
International Chemical Engineering, Vol 10, No 3, July 1970, p 427-431. 3 fig, 4 ref.

Descriptors: *Filters, *Equations, *Filtration, Pressure, Specific weight, Viscosity, *Waste water treatment, Filters.
Identifiers: *Vacuum filter, Throughput, *Filtrate, Filter cake, Specific resistance, Precipitate, Nomagram, Graphico-analytical procedure.

Because the throughput of a vacuum drum filter falls as the filter cloth becomes clogged, a method for determining the optimum initial thickness of the filter cake or the time required for one rotation of the drum, the optimum duration of the operating period of the filtration process and the mean throughput of the filter was proposed. A measure of the degree of plugging of the filter cloth is the decrease in the throughput of the filter or the thickness of the filter cake. The experimental relationships for the quantity of solids removed per square meter of the filter after one revolution and the thickness of the filter cake as functions of the number of revolutions of the drum were given by two equations. Curves for the change in quantity of the filter cake produced per revolution or in the thickness of the filter cake were drawn. On the basis of evaluations of experimental data for the dewatering of precipitates from the waste water in the viscose industry or industrial scale vacuum drum filters with knife removal of the filter cake, the relationship f (n) = e-Dn where D is an experimental coefficient, was obtained. Besides weight and thickness of filter cake other variables such as area of filter, volume of filtrate, moisture content of filtrate, specific weight of the filter cake, filtration pressure, filtrate viscosity, and mean specific resistance of the filter cake were taken into account. When the solution to the equation derived presents considerable analytical difficulty a graphico-analytical method can be used. (Biggs-Texas)
W72-04062

DALLAS WASTEWATER-RECLAMATION STUDIES,
Dallas City Water Utilities, Tex.
Henry J. Graeser.
Journal of the American Water Works Association, Vol 63, No 10, October 1971, p 634-640, 7 fig, 7 tab, 14 ref.

Descriptors: *Reclaimed water, *Water reuse, *Texas, Water law, Water management, Water purification, Research and development, Design criteria, Tertiary treatment, Potable water, Water quality control, Public health, Heavy metals, Pesticide removal, Viruses, Cost analysis, *Waste water treatment.
Identifiers: *Drinking water standards, *Dallas.

The City of Dallas, Texas has conducted considerable research into the possibility of renovation of municipal wastewater for use as potable water. Reclamation and reuse are realities in several locations now, but the use of reclaimed water in the United States now is impeded by two legal obstacles. USPH drinking water standards state that raw water supply will be from, 'the most desirable source which is feasible.' Sewage effluents have not been and are not now considered to be the most desirable source. In addition, the USPHS cannot legally establish standards, except to prevent communicable diseases, so there is no present regulatory agency which can establish the standards which reclaimed water must meet to be fit for public consumption. Much research still remains to be done to develop testing procedures and instrumentation to rapidly detect and identify pollutants in the water, and to assess the effects of different components both alone and in combination with other components. Examples of this are organic chemicals, including pesticides, insecticides, and herbicides, as well as the heavy metals and various trace elements. Dallas is currently expending $300,000 yearly on research and development of instrumentation, control, analysis procedures and criteria for re-use of treated effluent as potable water. (Lowry-Texas)
W72-04063

REMOVAL OF HYDROGEN SULPHIDE FROM WATERFLOOD INJECTION WATER,
Sohio Petroleum Co., Ohio.
R. C. Gould.
Journal of Petroleum Technology, Vol 22, August 1970, p 913-917, 4 fig, 2 tab, 10 ref.

Descriptors: *Waste water treatment, *Oil wells, Aquifers, Water pollution, *Hydrogen sulphide, Corrosion, Pipes, Texas.
Identifiers: San Andreas dolomite, Flue gas stripping, *Water flooding, Oil bearing strata.

In an attempt to increase the production of wells in an oil field in West Texas, water flooding was introduced. Water drawn from San Andreas dolomite formation was selected for this use. It was found that the hydrogen sulphide concentration of 300-500 ppm created several problems with the gas and oil produced. A company decision was made to treat the water rather than switch to another source. Hydrogen sulphide is stripped from the water by oxygen free (less than 0.25%) flue gas generated for the purpose by specially designed submerged burners. The project has been plagued with problems; however, most of the major problems have been resolved and the process appears to be a good solution for the provision of water free of hydrogen sulphide for water flooding of oil bearing strata. Conclusions drawn from 6 years of operating this system are: (1) Operation of these plants has presented many problems, and some of these have been partially solved; (2) Although the plants have not achieved full capacity, they have served a useful purpose in the Spraberry Driver unit; (3) The larger of the two plants operates at a considerably less cost per barrel than the smaller plant, but this may be the result of allocation of fixed costs and accounting practices rather than design; and (4) The process has successfully removed hydrogen sulphide from the San Andreas water. (Goessling-Texas)
W72-04064

MASS-TRANSFER EFFECTS IN MAINTAINING AEROBIC CONDITIONS IN FILM-FLOW REACTORS,
Rice Univ., Houston, Tex. Dept of Environmental Engineering.
C. J. Kehrberger, and A. W. Busch.
Journal Water Pollution Control Federation, Vol 43, No 7, July 1971, p 1514-1527, 9 fig, 3 tab, 21 ref.

Descriptors: *Trickling filters, *Anaerobic conditions, *Aerobic conditions, Mass-transfer, Oxygen, Turbulence, Nitrates, Sampling, Analytical techniques, Laboratory tests, Dissolved oxygen, Odors, *Waste water treatment.
Identifiers: *Film-flow reactors, *Hydrogen acceptors, Total soluble organic carbon.

Results from an experimental investigation of the removal of soluble organic compounds through an inclined rectangular plate reactor revealed that mass-transfer effects can result in decreased effectiveness of the biological reaction. Microorganisms were grown and maintained on the surface of the acrylic plate, and reactions were carried out with both oxygen (aerobic), and nitrate (anaerobic) as hydrogen acceptors. Under nominally aerobic conditions mass-transfer effects were manifested by production of putrefactive odors and buildup of organic intermediates in the liquid phase. In intentionally anaerobic systems where nitrate was used as the hydrogen acceptor, the need for interphase transport of oxygen was eliminated, and a greater removal of organic carbon, both primary substrate and the characteristic intermediates, was achieved. Interphase transport of reactants to the reaction site may have produced the difference in reaction rates in the two systems, but biochemical factors may also be important. These results indicate that full-scale trickling filters should provide turbulent conditions to minimize transport effects and should recirculate unsettled effluent to offset the decreased contact time resulting from the high flow velocities, resulting ultimately in a continous-flow stirred tank reactor. (Lowry-Texas)
W72-04065

A PROCEDURE FOR TREATMENT AND DISPOSAL OF WASTE WATER SLUDGE,
Passaic Valley Sewerage Commission, Newark, N.J.
Alexander S. Goldberg.
Journal Water Pollution Control Federation, Vol 43, No 9, September 1971, p 1912-1920, 7 tab, 3 ref.

Descriptors: *Sludge disposal, *Chlorination, *Dewatering, Air pollution, Water pollution control, Odors, Oxidation, Hydrogen ion concentration, Filtration, Vacuum drying, Screens, Color, Pulp and paper industry, *Waste water treatment.

A chlorination dewatering system of wastewater sludge treatment and disposal has been developed for use on primary sludge. Optimum solids content for filtration was 1% for the primary sludge. Odors were controlled by adding 500 mg/l of chlorine for each percent of sludge solids, and this chlorine addition was also found to significantly reduce filtration time of the sludge. A 5% sodium hypochlorite solution was used as a chlorine source, and while the primary sludges dealt with had a 5 to 1 or 4 to 1 volatile: mineral solids ratio before chlorination, the ratio after chlorination was 3:1 or 2:1. Filter residue remained 80% volatile, but the dissolved solids ratio in the filtrate dropped to 1:1 or less (volatile to mineral). Addition of from 10 to 30% waste paper was shown to improve the speed of filtration and the quality of the product. Forming the treated sludge on a paper machine would allow the product to be disposed of as paper, soil conditioner, or landfill, all without air or water pollution worries. (Lowry-Texas)
W72-04066

ENVIRONMENTAL PROTECTION ACTIVITIES IN A MULTIMILL PAPER COMPANY,
Westvaco Corp., New York.
O. B. Burns, Jr.
Journal Water Pollution Control Federation, Vol 43, No 10, October 1971, p 2026-2032, 6 fig.

Descriptors: *Pulp and paper industry, *Industrial wastes, *Pulp wastes, Leadership, Personnel, Management, Administration, Planning, New York, Water quality control, *Waste water treatment.
Identifiers: *Corporate activities.

Westvaco Corporation operates 7 pulp and paper mills and 36 paper and paperboard converting plants. Combined sales in 1969 amounted to $420 million. The various entities of the corporation follow a rigidly outlined schedule for the attainment of environmental quality goals. The five step pro-

gram includes anticipation, investigation, implementation, operation, and improvement goals. Environmental control activities are regarded as an integral part of the company's overall business activities, and they are conceived, designed, operated, and updated as such. Each operational change is preceded by written reports and recommendations, and followed by quarterly progress reports to ensure successful completion of the necessary tasks. By retaining this system, Westvaco hopes to keep all pollution control facilities growing with the industries involved to ensure safeguarding the environment. (Lowry-Texas)
W72-04067

LIBERTY, SOUTH CAROLINA, TEXTILE FINISHING WASTE,
South Carolina Pollution Control Authority, Columbia.
George A. Rhame.
Water and Wastes Engineering, Vol 7, No 5, May 1970, p C/6, 3 tab.

Descriptors: *Textiles, *Industrial wastes, *Activated sludge, Aeration, Design criteria, Odors, Sludge disposal, Biochemical oxygen demand, Alkalinity, *Waste water treatment.

Expansion of Liberty Mill No. 1 prompted mill management to construct separate waste treatment facilities for the 0.5 mgd of mixed alkaline dye wastes and sanitary sewage (approximately 30,000 gpd). An extended aeration system was designed, constructed, and went on stream in July 1965. The system incorporated a straight through flow pattern with a sludge recirculation at 250 gpm, and was designed to handle 1.0 mgd. Biological utilization of the starches and other carbohydrates was shown to produce ample carbon dioxide to neutralize the alkalinity of the wastes to a satisfactory degree. No odors near the plant or receiving water have been detected, and the effluent is clear and contains less than 20 mg/l BOD5 at the design load. No sludge disposal is necessary since any required sludge wasting can be handled by tank truck. (Lowry-Texas)
W72-04074

MUNICIPAL SUPPLY AUGUMENTED BY TREATED SEWAGE,
Standard Oil Co. (Ohio), Cleveland.
J. F. Elliott, and Joseph H. Duff.
Journal of the American Water Works Association, Vol 63, No 10, October 1971, p 647-650, 3 fig, 2 tab, 11 ref.

Descriptors: *Boiler feedwater, *Water softening, Ion exchange, Activated sludge, Water reuse, Filtration, Operation and maintenance, Industrial water, *Waste water treatment, Ohio.
Identifiers: *Refineries, *Lima (Ohio).

Expansion of the Lima refinery of the Standard Oil Company increased boiler feedwater requirements from 1200 to 2000 gpm. Based on a complete engineering study, it was decided to replace the existing manual hot-process-hot-ion-exchange system with a modern, high-rate solids-contact clarifier, dual-media air-scoured filters, and a continuous-countercurrent sodium-cycle ion-exchange system. Sufficient raw water was unavailable at the time of start-up, so mixed municipal water and activated sludge treated sewage effluent was used as influent. The refinery operated for approximately one year using mixed municipal water and treated effluent, and operation of the softeners, filters, and ion exchange units, along with proper internal treatment, was adequate for the demands of the boilers. Serious difficulties occurred due to the variation in composition of the effluent during winter run-off periods, making severe demands on operations. Use of design water was shown to be preferable because of lower dissolved solids content, more constant composition, and less need for constant operating attention. (Lowry-Texas)
W72-04076

WATER RESOURCES POLICY IN WISCONSIN: GENERAL SUPPORTING STUDIES, VOLUME II, APPENDIX,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
R. G. Fait.
Available from the National Technical Information Service as PB-206 222, $3.00 in paper copy, $0.95 in microfiche. Wisconsin Water Resources Center, Madison, Partial Completion Report, 1971. 139 p, 21 tab, 112 ref, append. OWRR B-038-WIS (3).

Descriptors: *Water pollution sources, *Waste water (Pollution), *Eutrophication, *Rainfall, *Costs, *Nutrients, *Sewage process, Activated sludge, Tertiary treatment, Wisconsin.
Identifiers: *Nutrient removal, *Phosphorus removal, *Microscreening, Alternatives, Parameters, Lake Michigan drainage basin, Southeastern Wisconsin.

Information relating to the technology and costs of nutrient removal is scattered and limited. A broad recapitulation of current primary, secondary, and tertiary processes for phosphorus control is presented. An extensive review of the literature is carried out to establish the range and costs of removal possibilities. Alternative phosphorus removal decisions are subsequently developed for existing facilities in the Wisconsin portion of the Lake Michigan drainage basin. The surveyed literature information is augmented by an investigation of local characteristics to determine discrete removal possibilities and associated average costs. The alternative removal choices serve as input into a least-cost, efficiency model of phosphorus removal policies developed in a separate study. (see also W72-01979, W72-04077 thru W72-04080) (Kuelz-Wisconsin)
W72-04079

NITROGEN REMOVAL FROM WASTEWATERS.
Federal Water Quality Administration, Cincinnati, Ohio. Advanced Waste Treatment Research Lab.

Available from the National Technical Information Service as PB-206 306, $3.00 in paper copy, $0.95 in microfiche. Federal Water Quality Administration Report, May 1970. 24 p, 35 ref. FWQA Project 17010---05/70.

Descriptors: *Nitrogen, *Separation techniques, *Waste water treatment, Ammonia, Nitrates, Nitrites, Amino acids, Biodegradation, Nitrification, Denitrification, Ion exchange, Chlorination, Oxidation, Cost analysis, Technical feasibility, Economic feasibility.
Identifiers: *Stripping.

The various forms in which nitrogen occurs in wastewater, and the equally varied methods used to remove these nitrogen compounds have been the subject of this progress report. The seven papers included provide first a brief review of some possible deleterious effects of nitrogen in the nation's wastewaters in the form of nitrites, nitrates, ammonia, ammonium ion, or dissolved nitrogen gas. Methods of removal which were studied included: (1) suspended growth biological reactors; (2) packed column biological reactors; (3) removal of ammonia nitrogen by air stripping; (4) removal of ammonia nitrogen by ion exchange; (5) removal of nitrates by ion exchange; and (6) miscellaneous other methods for removing various nitrogenous compounds. (See also W72-04086 thru W72-04092) (Lowry-Texas)
W72-04085

NITROGEN REMOVAL FROM WASTEWATERS--STATEMENT OF THE PROBLEM,
Federal Water Quality Administration, Cincinnati, Ohio. Advanced Waste Treatment Research Lab.
Edwin F. Barth, and Robert B. Dean.
In: Nitrogen Removal from Wastewaters, Paper No 1, May 1970. 6 p. FWQA Project 17010---05/70.

Descriptors: *Nitrogen, *Ammonia, Nitrates, Nitrites, Toxicity, Corrosion, Public health, Odors, Oxidation-reduction potential, Biochemical oxygen demand, Nitrification, Nutrients, Sludge, Algae, Bacteria, *Waste water treatment, Eutrophication.
Identifiers: *Methemoglobinemia.

Release of ammonia to a receiving water body may cause a variety of unwanted results. The toxicity of ammonia to adult humans is so slight as to require no limits in drinking water, although the presence of ammonia is regarded as evidence of pollution. However, infant humans, because of the lack of sufficient intestinal flora, are not able to reduce nitrites to nitrogen gas. The nitrite then combines with the hemoglobin which results in methemoglobinemia. High ammonia levels in drinking water will also dissolve copper plumbing. For these reasons, limits have been set at no more than 10 mg of nitrate nitrogen in water to be fed to babies, although no standards have been set for ammonia. The oxygen demand of nitrogenous material has significantly accelerated eutrophication in many areas, including the Potomac estuary, the Grand and Clinton Rivers in Michigan and Kanawha River in West Virginia. A nitrified effluent, however, will provide oxygen to sludge beds and prevent septic odors, be more efficiently and effectively disinfected by chlorine, and will contain less soluble organic matter than the same effluent before chlorination. (See also W72-04085) (Lowry-Texas)
W72-04086

NITROGEN REMOVAL BY BIOLOGICAL SUSPENDED GROWTH REACTIONS,
Federal Water Quality Administration, Cincinnati, Ohio. Advanced Waste Treatment Research Lab.
E. F. Barth.
In: Nitrogen Removal from Wastewaters, May 1970, Paper No 2. 3 p, 2 fig. FWQA Project 17010--05/70.

Descriptors: *Anaerobic conditions, *Nitrification, *Denitrification, Nitrogen, Ammonia, Biodegradation, Absorption, Temperature, Cost analysis, Waste water treatment.
Identifiers: *Process control, *Packed column reactors, *Suspended growth reactors, Methyl alcohol.

Good process control is required to ensure the biological transformation of ammonia nitrogen to nitrate nitrogen, since any reduced nitrogen compounds entering the denitrification stage of a 3-stage biological nitrogen removal system will pass through unaltered. The high rate system handles the bulk of the carbonaceous removal, so the nitrification stage receives a predominantly ammonia nitrogen feed, and an enriched culture develops since each system has its own sludge recycle. The high rate system protects subsequent nitrification stages in that heavy metals, cyanides, thiocyanates, and toxic organic chemicals are either sorbed, or biodegraded before they reach the nitrification stage. Establishment of controlled nitrification allows addition of methyl alcohol to the nitrified effluent in an anaerobic reactor to force the reaction and thus provide complete control. Packed column processes have been investigated, but suspended growth reactors would be favored for installations in excess of 2 MGD. Capital cost of the system would be 25% more than conventionally designed plants, but an effluent of 2 mg/l or less total nitrogen would be produced. (See also W72-04085) (Lowry-Texas)
W72-04087

NITROGEN REMOVAL FROM WASTEWATERS BY COLUMN REACTORS,
Federal Water Quality Administration, Cincinnati, Ohio. Advanced Waste Treatment Research Lab.
J. M. Smith.
In: Nitrogen Removal from Wastewaters, May 1970, Paper No 3. 2 p, 1 fig. FWQA Project 17010--05/70.

Descriptors: *Anaerobic digestion, *Methane bacteria, *Nitrification, *Denitrification, Nitrogen, Nitrates, Fermentation, Slimes, Turbidity, Efficiencies, Cost analysis, Pilot plants, *Waste water treatment.
Identifiers: *Packed columns, *Contact time, *Surface area, Throughput, Backwashing, Pressure drop, Suspended solids, Methanol.

When supplied with a suitable organic carbon source under anaerobic or near anaerobic conditions, a variety of facultative bacteria common to wastewater will use nitrates and nitrites as the terminal hydrogen acceptors during the fermentation of the added substrate and ultimately form nitrogen gas. Use of these bacteria in a packed column for nitrogen removal has three advantages: (1) large contact surface; (2) short diffusion distances afforded by small media; and (3) the cell residence time of the surface bound slime is much greater than the hydraulic residence time. 90% nitrate reduction has been achieved at contact times of 10 min. for sand and 30 min. for 3/4 inch stone, producing an effluent of less than 2 mg/l nitrate nitrogen and effluent turbidities less than 3 JTU. Downflow operation has been successful for these media at surface loading rates of 7.0 gpm/ft., requiring a 1-3% volume of throughput for backwashing. Use of larger media permits operation without backwashing at the expense of longer contact times and increased effluent suspended solids. Columns of 2 inch aggregate have operated continuously for over 6 months on agricultural subsurface drainage without efficiency loss or solids accumulation. Chemical cost of removing 20 mg/l NO3-N in the presence of 5 mg/l dissolved oxygen is estimated at 1.6 cent/1000 gallons if methanol is used in the packed column configuration. (See also W72-04085) (Lowry-Texas)
W72-04088

AMMONIA NITROGEN REMOVAL BY STRIPPING WITH AIR,
Federal Water Quality Administration, Cincinnati, Ohio. Advanced Waste Treatment Research Lab.
J. B. Farrell.
In: Nitrogen Removal from Wastewaters, May 1970, Paper No 4. 3 p. FWQA Project 17010—05/70.

Descriptors: *Ammonia, *Solubility, *Separation techniques, Temperature, Freezing, Chemical precipitation, Sludge, Calcium carbonate, Cost analysis, Waste water treatment.
Identifiers: *Desorption, *Stripping, Pressure drop.

Ammonia can be desorbed or stripped from solution by raising the pH of the solution to the point where the ammonium ion is converted to dissolved ammonia, and contacting the solution with ammonia free air. Municipal wastewater normally contains 15 to 25 mg/l of ammonium ion which is removable by stripping, but the volume of air required is nearly 400 cu. ft./gallon of wastewater in a counter current-flow packed tower. Pressure drop across a packed tower is one psi, and since power is proportional to the product of pressure drop and volumetric flow rate, power costs were prohibitive. Development of a slat filled tower in lieu of a packed tower halved the pressure drop and so reduced power costs at Lake Tahoe, where 90% removal efficiencies were then obtained in a 24 ft.high counter current tower. Problems with ammonia stripping include the increased solubility of ammonia in cold water making winter operation more costly. Scaling problems have also occurred in several of the locations now using the process, although the scale did not adhere to the tower in South Africa. Cost has been estimated at 2.9 cent/1000 gallons of wastewater treated exclusive of the cost of lime and facilities to raise the pH to 11.0. In colder weather, costs will increase sharply. An operating pH of 10.5 counter current operation rather than crossflow, and an openfill to allow easy flushing of accumulated solids will help to control scale in the tower. (See also W72-04085) (Lowry-Texas)
W72-04089

REMOVAL OF AMMONIA NITROGEN BY SELECTIVE ION EXCHANGE,
Federal Water Quality Administration, Cincinnati, Ohio. Advanced Waste Treatment Research Lab.
R. B. Dean.
In: Nitrogen Removal From Wastewaters, May 1970, Paper No 5. 3 p. FWQA Project 17010—05/70.

Descriptors: *Ammonia, *Ion exchange, *Zeolites, Adsorption, Selectivity, Hydrogen ion concentration, Separation techniques, Cost analysis, Chemical precipitation, *Waste water treatment.
Identifiers: *Ammonium ion, *Regeneration, Limewater, Ammonia stripping.

At pH 9.5 and below, ammonia exists in solution primarily as the ammonium cation, which is similar in size to the potassium ion and is precipitated by the same reagents that precipitate potassium. Adsorption of ammonium ions is similar to that of potassium or sodium ions on ion exchange resins, making conventional water softening unacceptable for ammonia removal. Total deionization is possible but too costly. However, certain Zeolites, including naturally occurring clinoptilolite, have been shown to have a high selectivity for ammonia in natural and wastewaters. A trailer mounted 100,000 gpd demonstration plant was designed and constructed to incorporate: (1) an inclined-tube settler clarifier to remove turbidity from the feed to prevent solids deposition and plugging of the zeolite columns; (2) a three column exchange series with two columns operating continuously; (3) regeneration by backwashing with limewater containing sodium chloride to speed up the rate of regeneration. The ammonia-laden (500 mg/l) limewater is then stripped of ammonia by heated air passing through a packed tower. A cost estimate of 8.1 cent/1000 gallons has been reported for ion exchange ammonia removal, exclusive of costs for disposing of ammonia laden brines. Costs estimates for the trail-mounted unit have been reported as 3-6 cents/1000 gallons treated for the zeolite method, with work continuing to find alternative means of final disposal of the ammonia. (See also W72-04085) (Lowry-Texas)
W72-04090

ION EXCHANGE FOR NITRATE REMOVAL,
Federal Water Quality Administration, Cincinnati, Ohio. Advanced Waste Treatment Research Lab.
R. A. Dobbs.
In: Nitrogen Removal from Wastewaters, May 1970, Paper No 6. 2 p. FWQA Project 17010—05/70.

Descriptors: *Ion exchange, *Separation techniques, *Nitrates, Selectivity, Anions, Brine disposal, Sludge, Technical feasibility, Economic feasibility, *Waste water treatment.
Identifiers: *Regeneration.

A resin with a high selectivity for nitrate ion over other anions comparable to the selectivity of resins used for water softening, does not presently exist. Tests conducted to provide a technical and economic evaluation of the feasibility of removing nitrates from irrigation return flow have shown that although commercially available resins do have selectivity over chloride, the selectivity ratio must be 20 to 1 for the process to be economical. Should such a resin be developed, efficiency of sodium chloride regeneration is only 1%, and disposal of the resulting nitrate laden brine would be difficult. Reaction with ferrous sulfate and neutralization with lime would produce nitrogen gas, but chemical sludges difficult to dispose of would also result. Several research efforts are continuing, but until these obstacles have been surmounted, selective nitrate removal will remain unfeasible. (See also W72-04085) (Lowry-Texas)
W72-04091

OTHER METHODS FOR REMOVING NITROGEN,
Federal Water Quality Administration, Cincinnati, Ohio. Advanced Waste Treatment Lab.
R. B. Dean.
In: Nitrogen Removal from Wastewater, May 1970, Paper No 7. 3 p. FWQA Project 17010—05/70.

Descriptors: *Nitrogen, *Ureas, *Oxidation, Ammonia, Chlorination, Chlorine, Disinfection, Amino acids, Chemical precipitation, Phosphates, Detergents, Biodegradation, *Waste water treatment.
Identifiers: *Hypochlorite, Nitrilotriacetic acid.

Nitrogen may occur in wastewaters in the form of amino acids, nitrilotriacetic acid (NTA), urea, and organic nitrogen, as well as in the form of nitrites, nitrates, ammonia, and dissolved nitrogen gas. Amino acids are readily removed by either biodegradation, or lime precipitation and carbon columns. NTA is not considered a problem since it is readily biodegradable and not expected to exceed 2 mg/l as nitrogen in wastewaters. Urea, fortunately, is rapidly hydrolyzed to ammonia. Organic nitrogen is commonly present in the form of bacteria or parts of bacteria and is removable by settling-clarification. Soluble nitrogen compounds other than urea can be removed by any desalting or deionizing process, although no selectivity for the compounds is evidenced, and all the ions must be removed. Chlorination of ammonia requires 10,000 tons of chlorine per year for a city of 200,000 and produces an equivalent weight of hydrochloric acid. The cost for oxidizing a water containing 20 mg/l of ammonia is 6 cents/1000 gallons treated. Cost estimates have not been made for the other treatment methods, but they would presumably be higher than the methods for removal of the conventional nitrogen compounds. Use of hypochlorite in lieu of chlorine has greatly increased despite its higher cost since it is much safer to handle and use. (See also W72-04085) (Lowry-Texas)
W72-04092

CONTROLLING FACTORS IN METHANE FERMENTATION,
New Mexico State University, University Park. Engineering Experiment Station.
R. E. Speece, and Ralph Clark.
Available from the National Technical Information Service as PB-206 237, $3.00 in paper copy, $0.95 in microfiche. Engineering Experiment Station Technical Report No 61, NMSU-EES-61-70, September 1969. 134 p, 59 fig, 9 tab, 110 ref. FWPCA Project 17070—06/69.

Descriptors: *Hydrogen ion concentration, *Inhibition, *Methane bacteria, Anaerobic digestion, Fermentation, Sludge, Acids, Chemical oxygen demand, *Waste water treatment, *Fermentation.
Identifiers: *pH inhibition factor, Acetate, Recovery, *Methane fermentation.

Laboratory anaerobic filters were used to: (1) determine the effect of varying pH levels on relative rate of methane production; (2) determine the duration of the effect of non-optimum pH levels on the fermentation rate; and (3) determine what fermentation recovery time can be expected from non-optimum pH levels and what effect the non-optimum pH duration has on this recovery. The pH inhibition factor (rate of methane production or COD stabilization at an inhibitory pH level divided by the production or stabilization rate at the previous non-inhibitory level) was used to allow direct comparison of digesters having different COD stabilization rates. Results indicated that steady state acetate fermentation by methane forming bacteria was possible at a pH as low as 4.0, although the fermentation rate was measurably slower than the rate at pH 6.0 to 8.0, the range where pH was determined to be non-inhibitory. Recovery from low pH levels required two days after a 12 hour pH drop, and was not dependent on the low pH duration after a 2 day pH drop,

with the recovery time being considerably longer. A pH level of 9.0 stopped acetate fermentation, but recovery to prior levels after pH restoration occurred within two days. The mechanism of inhibition was not defined, but recovery did not seem to be a bacterial population regeneration phenomena. (Lowry-Texas)
W72-04097

FLOCCULATION AND CLARIFICATION OF MINERAL SUSPENSIONS.
Minnesota Univ., Minneapolis. Mineral Resources Research Center.

Copy available from GPO Sup Doc for $1.25; microfiche from NTIS as PB-206 238, $0.95. Environmental Protection Agency - Water Quality Office, Water Pollution Control Research Series, May 1971. 108 p, 53 fig, 9 tab, 64 ref. EPA Project 14010 DRB 05/71.

Descriptors: *Mineral industry, *Suspension, *Flocculation, Settling velocity, Viscosity, Zeta potential, Particle size, Filtration, Adsorption, Colorimetry, Regression analysis, Calcium chloride, Quartz, *Waste water treatment.
Identifiers: *Goethite, *Starch, Polyacrylamide, Streaming potential, Selective flocculation.

Starch and calcium chloride were used as flocculants in a study of the flocculation and clarification characteristics of quartz and geothite suspensions. Settling rates of the suspensions, the amount of suspended solids in the supernatant liquid and the concentrations of the residual starch and calcium ion were monitored. The effects of the size distribution and the pulp dilution of the minerals, of the temperature, and of the chemical modification of the starch structure were also investigated. Goethite suspensions were shown to be readily flocculated with clear supernatant liquid using starch over a wide range of pH, whereas quartz suspensions could not be flocculated with starch in the absence of calcium ion. The resultant supernatant liquid was extremely difficult to clarify, even in the presence of an excessive amount of calcium ion. A cationic starch of a certain molecular size and degree of substitution or a combination of a polymeric compound and a cation capable of reversing the charge of the quartz showed some promise in the clarification of quartz suspensions. The most effective flocculation and clarification condition was observed when a polymeric compound was adsorbed uniformly in sufficient quantity and in a stretched-out conformation, and when the zeta potential of the resulting suspension was made close to zero. (Lowry-Texas)
W72-04098

MICROBIOLOGICAL TREATMENT OF ACID MINE DRAINAGE WATERS.
Continental Oil Co., Ponca City, Okla. Research and Development Dept.

Copy available from GPO Sup Doc for $1.00, microfiche from NTIS as PB-206 231, $0.95. Environmental Protection Agency - Research and Monitoring, Water Pollution Control Research Series, September 1971. 78 p, 27 fig, 21 tab, 22 ref. EPA Project 14010 ENW 09/71.

Descriptors: *Acid mind wastes, *Oxidation, *Iron bacteria, *Sulfur bacteria, Hydrogen ion concentration, Temperature, Ammonia, Phosphates, Nitrogen, Neutralization, Laboratory tests, Pilot plants, Water quality control, *Waste water treatment.

Laboratory tests demonstrated the ability of acidophilic iron bacteria to oxidize ferrous iron in acid mine drainage waters to prepare such waters for relatively inexpensive limestone neutralization. Iron bio-oxidation rate was determined to be directly proportional to iron concentration for ferrous iron levels between 10 and 9000 mg/l. Oxidation was also shown to be temperature dependent with the most rapid oxidation generally occurring between 20 and 30 deg C and decreased rates occurring at either higher or lower temperatures. The reaction required aeration rates of 1/100 VVM to support microbial oxidation of 500 mg/l ferrous iron, between 1 and 10 mg/l ammonia to support microbial oxidation of 800 mg/l of ferrous iron, and between 0.55 and 5.5 mg/l of phosphate to support microbial oxidation of 9000 mg/l of ferrous iron. Series multistaging of reaction vessels offered significant operational efficiency over a single stage. Although sulfate reducing bacteria were present in all samples, they neither grew nor produced H2S at pH below 5.5. Significant scale-up problems were encountered in going from 1 1/2 gallon laboratory scale system to a 1000 gallon pilot plant oxidation vessel for reasons as yet unknown. (Lowry-Texas)
W72-04100

FACTORS AFFECTING NITRIFICATION KINETICS,
Metcalf and Eddy, Inc., Boston, Mass.
Thomas C. McMahon, Harry E. Wild, Jr., and Clair N. Sawyer.
Journal Water Pollution Control Federation, Vol 43, No. 9, Sept. 1971, p 1845-1854, 15 fig, 1 tab, 11 ref. 68-1.

Descriptors: *Nitrification, *Bacteria, *Inhibition, Ammonia, Nitrogen, Temperature, Hydrogen ion concentration, Biochemical oxygen demand, Laboratory tests, Pilot plants, *Waste water treatment, Treatment facilities.
Identifiers: *Mixed liquor volatile suspended solids, Secondary effluent, Operating conditions, Detention time, Extended aeration.

A 10 gpm pilot nitrification plant was operated on secondary effluent open to the weather, from October 1969 to April 1970. Laboratory studies were performed to measure the response of the reaction kinetics of the process to variations in temperature, pH, mixed liquor volatile suspended solids (MLVSS), biochemical oxygen demand, and ammonia levels. Results demonstrated that: (1) ammonia nitrogen concentrations were not inhibitory to nitrification in concentrations of less than 60 mg/l; (2) optimum pH was 8.4, with pH variations exhibiting significant effects; (3) temperature also affected the nitrification rate, with the rate increasing through the temperature range of 5 to 30 deg C, in reasonable agreement with the Van't Hoff-Arrhenius Law; (4) the time required for nitrification is directly proportional to the amount of nitrifiers present in the system; and (5) neither instantaneous BOD concentration increases (from 50 to 110 mg/l) or decreases (from 50 to 5 mg/l) affected the nitrification rate. However, it was expected that a change in average BOD concentration would affect that percentage of the MLVSS that is composed of nitrifiers and as a result, would affect the time necessary for nitrification. (Lowry-Texas)
W72-04103

5E. Ultimate Disposal of Wastes

WHAT YOU PUT INTO YOUR VEHICLE MAY CONTROL ITS FUTURE,
Kenneth M. Pollock.
Solid Wastes Management and Refuse Removal Journal, Vol 12, No. 8, August 1969, p 26-27 and 38.

Descriptors: *Solid wastes, *Industrial wastes, *Transportation, *Waste disposal, Farm wastes, Paints, Liquid wastes, Protective linings, Plastics, Operation and maintenance, Landfills, Cost analysis.
Identifiers: *Deep-well disposal.

Careful though and planning on the part of the private disposal contractor may largely elimate both premature equipment failure and costly solutions to simple problems. Metal shaving, foundry dust, and broken glass, all capable of ruining collection and compaction equipment can be easily dealt with if roll-on, roll-off containers are used, with caution exercised to ensure that the filled container is not too heavy to lift. Construction rubble may also be dealt with in containerized fashion, the difference being that the containers are emptied by special equipment into the truck bed. Suggestions for deep well disposal of liquids, use of available equipment to crush and landfill car bodies without specialized equipment or personnel, and the used or incinerator flyash to absorb paint sludge are discussed. An approach to transporting organic, wet refuse through the use of plastic liners is also presented. (Lowry-Texas)
W72-03747

DISPOSAL OF WASTE SLUDGE FROM WATER SOFTENING PLANTS,
M. Fulmer.
Water and Wastes Engineering, Vol. 7, No. 8, August 1970, p33.

Descriptors: Water softening, Lime, *Sludge disposal, Calcium carbonate, Acid soils, Waste disposal.
Identifiers: Calcining, Gas cleaning, Sulphur dioxide, Building materials.

Although more and more states are requiring water softening plants to dispose of their water lime sludges by means other than by discharging them into streams or lakes, no first rate method of disposal has been suggested, particularly for small plants of less than 10 MGD. Most small plants cannot pay the capital costs for calcining equipment and resort to lagooning the sludge. There are excellent uses for these lime sludges if the proper management of such materials can be instituted. It would seem that this is an instance where a governmental agency, either state or federal, should provide disposal facilities. By serving a number of small water treatment plants, a sludge processing center could be equipped economically to provide the lime or lime product currently in demand. This would not only provide a reliable method of disposal of lime sludge, thereby preventing pollution of the land and water, but would at the same time conserve and utilize a mineral resource. The present method of making the sludge producers responsible for sludge disposal merely nibbles around the edges of the problem and produces erratic results at best. A large scale approach is needed to solve this problem equitably, economically, and in the national interest. (Goessling-Texas)
W72-03750

DEEP-WELL INJECTION OF WASTEWATER,
New York State Dept. of Health, Albany.
T. J. Tofflemire, and G. P. Brezner.
Journal Water Pollution Control Federation, Vol 43, No 7, July 1971, p 1468-1479, 5 fig 1 tab, 39 ref.

Descriptors: *Waste disposal, *Brine disposal, *Radioactive wastes, *Industrial wastes, Geology, Permeability, Toxicity, Operation and maintenance, Monitoring, Hydraulics, Rock mechanics, Pressure, Fractures (Geology), Earthquakes.
Identifiers: *Deep-well disposal.

A summary of existing practice of deep-well injection of liquid wastes in the United States, with particular reference to New York State, was developed. The three major types of liquid amenable to deep-well disposal are salt water, industrial wastes, and radioactive wastes. Deep-well injection should be selected only after it has been determined that such disposal methods will have the least adverse effect on the environment of all feasible treatment methods. The most suitable strata for injection include sand, sandstone, or limestone, and injection wells must have an overlying stratum of impermeable caprock, such as shale, salt or clay. Abandoned wells and faults must be avoided and the disposal strata must be isolated from any usable water or natural

resources. Waste injected should be highly concentrated in small volumes, non-corrosive, and free of suspended solids and microorganisms. Compatibility tests of the strata for the wastewater should also be conducted. Well construction should be carefully supervised and the well monitored for pressure, flow and other parameters. Disposal zone pressure should generally be limited to 0.8 psi/ft. of depth. A listing of pertinent current literature is included. (Lowry-Texas)
W72-04068

5F. Water Treatment and Quality Alteration

HISTORY AND PRESENT STATUS OF CHLORINATION PRACTICE IN KANSAS,
Kansas State Board of Health, Topeka.
R. L. Culp.
Journal of the American Water Works Association, Vol. 3, No. 7, p 888-896, July 1960. 3 figs, 4 refs.

Descriptors: *Water purification, *Disinfection, *Chlorination, *Diseases, *Standards, Water supply, Kansas.
Identifiers: Hypochlorites.

Traces the progress in delivering safe water in Kansas from 1908 to 1960. The first use of hypochlorite was in 1908, liquid chlorine use started in 1917, the Newton water epidemic was in 1942, and the State ordered chlorination of all supplies in 1956. By 1942 all 60 surface water supplies were chlorinated as well as 40 ground water supplies, but there remained 241 ground water supplies not chlorinated. Only 60% of all supplies met the Drinking Water Standards. The 1942 epidemic of 3,000 cases of bacillary dysentery at Newton was due to contamination of a well water supply after it had reached the distribution system. Many supplies adopted chlorination thereafter and the State recommended chlorination of all supplies to maintain adequate residuals in the systems. By 1956, 70% of all supplies were being chlorinated but there were still 127 unchlorinated well water supplies, 37 of which failed to meet USPHS Standards for bacterial quality. The State ordered chlorination of all public supplies by Jan. 1, 1958. By 1960 only 1 supply remained unchlorinated and 95 per cent of all supplies met the bacteriological standard of the USPHS. (Bean-AWWA)
W72-03542

ALGAE AND OTHER INTERFERENCE ORGANISMS IN WATER OF THE SOUTH CENTRAL UNITED STATES,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
C. M. Palmer.
Journal of the American Water Works Association, Vol. 3, No. 7, p 897-914, July 1960. 2 tab, 91 ref.

Descriptors: *Water treatment, *Algae, *Algal control, *Taste, *Odor, *Natural streams, *Distribution systems, Chlorination, Copper sulfate, Activated carbon, Water supply.
Identifiers: South - Central States.

Covering the 6 south-central states of Alabama, Arkansas, Louisiana, Mississippi, Oklahoma, and Texas, the differences in different watersheds are discussed along with the types of organisms most prevalent, the difficulties caused in treatment plants, in impoundments, and by infestations in distribution systems. Tastes and Odors caused are discussed, also toxic algae. Control by chemicals such as copper sulfate, algicides, chlorine and chlorine-ammonia are discussed. The common use of activated carbon is elaborated, also mechanical controls for reducing taste and odors in a filter plant. Ninety - one references are noted. (Bean-AWWA)
W72-03562

USE OF SODIUM ALUMINATE AS A COAGULANT AT COUNCIL BLUFFS,
Council Bluffs City Water Works, Iowa.
M. E. Rew.
Journal of the American Water Works Association, Vol 52, No 7, p 852-856, July 1960. 2 fig, 1 tab.

Descriptors: *Water treatment, *Sodium compounds, Lime, Filtration, Water softening.
Identifiers: *Sodium Aluminate, *Soda Ash, Nalco 614.

The successful use is reported of new form of sodium aluminate Nalco 614 in conjunction with lime-soda ash softening at Council Bluffs, and the advantages over the use of alum are: (1) simple to control, (2) more economical than alum, (3) lime requirements were reduced, (4) soda-ash requirements were substantially reduced, and (5) filter beds stay in better condition. In coagulation and floc formation the sodium aluminate proved very effective for a period, though later it was found necessary to apply some alum also to trigger the reaction. (Bean-AWWA)
W72-03565

USE OF POLYPHOSPHATES FOR DEVELOPING PROTECTIVE CALCITE COATINGS,
Michigan State Univ., East Lansing.
R. F. McCauley.
Journal of the American Water Works Assocation, Vol 52, No 6, p 721-734, June 1960. 4 fig, 4 tab, 14 ref.

Descriptors: *Water treatment, *Phosphates, Calcium carbonate, *Calcite, Water supply.
Identifiers: Driving Force Index, Momentary Excess.

A useful approach to the problem of the formation of protective calcium carbonate coatings in iron mains was developed. Utilizing the Driving Force Index (DFI) and Momentary Excess (ME), calcite coatings were obtained in a matter of few hours. Addition of 0.5 to 1.5 ppm metal phosphate controls calcium carbonate precipitation and permits use of higher mometary excess values. Procedures, concentrations, calculations, time factors and results are discussed. (Bean-AWWA)
W72-03566

TASTE THRESHOLD CONCENTRATIONS OF METALS IN DRINKING WATER,
Public Health Service, Cincinnati, Ohio. Water Supply and Pollution Branch.
J. M. Cohen, L. J. Kamphake, E. K. Harris, and R. L. Woodward.
Journal of the American Water Works Association, Vol. 52, No. 5, p 660-670, May 1960. 4 fig, 6 tab, 19 ref.

Descriptors: *Analytical techniques, *Taste, *Metals, Manganese, Iron, Copper, Water supply.
Identifiers: Zinc.

Taste thresholds determined by use of test panels showed extreme variation in the level at which 5% of the panel will detect the metal and the level at which 95 per cent will detect the same metal. Zinc (sulfate) in distilled water was detected at 4.3 ppm by 5 per cent but only at 62 ppm by 95 per cent. Copper (chloride) was detected by 5 per cent at 2.6 ppm but only at 15.8 ppm by 95 per cent of the panel. For iron and manganese the spread was amazing, iron 0.04 to 256. ppm and manganese 0.9 to 487. ppm. Except for the iron, solution of the metal ions in spring water increased the level at which threshold was determined very markedly. The 50 per cent detection level on zinc went from 17.6 ppm with distilled water to 27.2 ppm, copper from 6.6 to 12.7, and manganese from 45 to 166 ppm, iron however dropped from 3.4 to 1.8 pp. (Bean-AWWA)
W72-03585

COAGULATION OF ACTIVATED CARBON SUSPENSIONS,
Northwestern Univ., Evanston, Illinois. Environmental Health Engineering.
For primary bibliographic entry see Field 05D.
W72-03614

WATER TREATMENT PLANT AUTOMATION IN THE UNITED KINGDOM,
Binnie and Partners, London (England).
For primary bibliographic entry see Field 05D.
W72-03615

DESIGN AND CONSTRUCTION (MIDLAND TREATMENT PLANT),
McNamee, Porter and Seeley, Ann Arbor, Mich.
J. C. Seeley.
Journal of the American Water Works Association, Vol 52, No 4, p 449-455, April 1960. 2 figs.

Descriptors: *Water treatment, Facilities, *Design, *Concrete construction, *Filters, Fluorides, Equipment, Lime, Michigan.
Identifiers: *Surface wash, Ferric sulfate, PeriFilter, Midland (Mich).

Improvement program approved March 1956, included modifications to the existing 7-mgd filtration, 100-mil gal raw water reservoir, Midlands' share in an additional pumping station on Lake Huron, and new 8-mgd filtration plant, with filtered water reservoir and high service pumping station. The plant was the type developed by E. H. Aldrick with peripheral filters around the mixing-solids contact basins. Other installations had been in milder climates. It was decided that construction should be concrete rather than steel used elsewhere. For flexibility, four 2-mgd units were chosen. Mixing is caused by the turbulence created by entrance jets impining on the tank botton. Because of poor results, the coagulant was changed from alum to ferric sulfate. Both surface wash and backwash are provided, the surface wash consisting of fixed nozzles. Four chemicals are used: quicklime ferric sulfate, sodium fluoride or sodium silicofluoride, and chlorine. (Bean-AWWA)
W72-03617

PACKAGE PLANT OVERCOMES WATER SHORTAGE,
For primary bibliographic entry see Field 05D.
W72-03627

ADVANCES IN POLLUTION CONTROLS ARE EXPLORED AT AIR/WATER CONFERENCE,
For primary bibliographic entry see Field 05D.
W72-03635

STARTUP AND OPERATION (MIDLAND TREATMENT PLANT),
Midland Utilities Dept., Mich.
C. A. Froman.
Journal of the American Water Works Association, Vol 52, No 4, p 455-460, April 1960. 3 fig.

Descriptors: *Training, Mechanical equipment, *Operation, Sludge stability, Solids contact process, Michigan, Water treatment, Water supply, Permits.
Identifiers: Operator certification, Midland (Mich).

Since the city was being supplied from a older plant, operation of the new Midland Treatment plant could be started and stopped whenever desired for major alterations, making the adjustments comparatively easy. Hiring one new operator in advance of operation allowed his assignment to the plant to follow construction and installation. Operator instruction classes were initiated, with emphasis on types of equipment in the new plant, gradually shifting to mathematics, chemistry and bacteriology. Since this program started all opera-

tors have become certified. Because of favorable reaction it is planned to continue the classes 2 hours each week, except during the summer. It took six months of periodic trials and readjustments to get the plant mechanically functioning as desired. Likewise nearly six months were required before a satisfactory sludge blanket was obtained. The many difficulties are discusses individually. (Bean-AWWA)
W72-03640

USE OF ACTIVATED CARBON TO PREVENT WATER SUPPLY CONTAMINATION,
West Virginia Pulp and Paper Company, Covington, Va. Carbon Technical Service Lab.
For primary bibliographic entry see Field 05G.
W72-03641

BASIC MECHANISMS OF COAGULATION,
Florida Univ., Gainesville.
A. P. Black.
Journal of the American Water Works Association, Vol 52, No 4, p 492-501, April 1960. 9 fig, 11 ref. PHS RG-4516.

Descriptors: *Water treatment, *Coagulation, *Colloids, *Stability, *Electrolytes, *Zeta, potential.

Substances causing turbidity are, for the most part, colloidal, therefore it is necessary that the water chemist familiarize himself with the properties and behavior of colloids. Colloid chemistry was originally defined as the physical-chemical phenomena of particles within a certain size range 5-200 mu. This definition is too confining as the most important properties are surface effects at enterfaces, and the surface areas involved are extremely great. The author discusses: instability and stability factors, including the Brownian movement and the Van der Waals forces of attraction; nature of Zeta potential; coagulation of colloids; polyelectrolytes; mechanism of polyelectrolyte action; mechano-chemical effects, and electron microscope studies. The mode of action of some of the non-ionic natural materials is not clear. These are no fixed rules to guide the selection of a coagulant for use with a given water. The jar test is still the only aid. Discussion is included by Thomas M. Riddick on zeta potential studies, electrophoresis, treatment of wastes, and coagulants and coagulant aids. (Bean-AWWA)
W72-03679

EVALUATING THE TASTE AND ODOR CONTROL PROBLEM,
Sanitary Engineering Consultant, Ann Arbor, Mich.
J. E. Kinney.
Journal of the American Water Works Association, Vol 52, No 4, p 505-519, April 1960.

Descriptors: *Water treatment, *Phenols, *Taste, *Odor, Decomposing organic matter, Activated carbon, Chlorine.
Identifiers: Chlorine dioxide.

From a study of the Mahoning-Beaver rivers, no relationship was found between phenol concentration and maximum odors developed. Maximum odors were due to cleanout of organics low in phenol concentration but high in odor intensity and chlorine demand. High chlorination reduced the concentration of phenol found on test. The rate of biologic oxidation of phenol in the river increased with increase in concentration, and increases with temperature. With temperatures of 70 to 80F the very high discharge (3,600 lb/day) was nearly gone before it reached the confluence of the Shenango River. Chlorine dioxide in the dosages employed reduced odor but had little or no effect on the phenol. Carbon reduced phenol with exceeding 18 ppb but not by any consistent amount, or to any given level. Discussion by Richard D. Hoak, points out that decay of vegetation is the principle cause of bad-tasting water and that medicinal tastes are not uncommon on virgin streams. He cites the very high chlorine-demand and the chloro phenol tastes found in research on oak leaf infusions. (Bean-AWWA)
W72-03683

STATUS OF FLUORIDATION IN THE UNITED STATES AND CANADA, 1958.
American Water Works Association, New York. Task Group 262OP.

Journal of the American Water Works Association, Vol 52, No 3, p 301-307, March 1960. 3 fig, 7 tab, 5 ref.

Descriptors: *Water treatment, *Fluoridation, *Fluorides, Water supply, Public health.

By the end of 1958 more than 36 million people were drinking water provided by 1,000 systems that were adding controlled amounts of fluorides to the water supplies. Nearly 40 per cent of all communities with population of 10,000 or more were using fluoridated water, compared to less than 30 per cent of such communities using fluoridated water in 1956. Even in the population group of 1000 to 2500 there were 338 communities using fluoridation. Sodium silicofluoride continued to be the chemical used by most systems, large and small. Sodium fluoride was used by a large number of smaller systems, while the use of fluosilicic acid was growing among both large and small communities. Only two communities used calcium fluoride, and no ammonium fluosilicate installations had been instituted since 1954. The supply of fluosilicic acid was critical in 1958 though sodium silicofluoride and sodium fluoride supplies were ample. (Bean-AWWA)
W72-03687

MIAMI LIME RECOVERY PLANT,
Miami Dept. of Water and Sewers, Fla.
C. F. Wertz.
Journal of the American Water Works Association, Vol 52, No 3, p 326-332, March 1960. 4 tab, 1 ref.

Descriptors: *Water treatment, Facilities, *Calcium carbonate, *Sludge, *Lime, *Centrifugation, Carbon dioxide, Water softening, Hardness (Water).
Identifiers: Kilns.

Calcium carbonate sludge from three clarifiers is pumped to two 32-ft. diameter, 15-ft. deep concrete thickener tanks with thickener mechanism. Thickened slurry flows to two dewatering centrifuges (40X60 in) driven by 60-hp motors. Filter cake is delivered by screw conveyor to the kiln. The rotary kiln is 7.5 ft. diameter and 230 ft. long with an integral multicylinder cooler. Carbon dioxide from the burning is delivered to the recarbonation basins of the softening plant. Operating data are presented and compared with the cost of purchasing lime, which was sometimes difficult to obtain. (Bean-AWWA)
W72-03689

ELECTROPHORETIC STUDIES IF COAGULATION FOR REMOVAL OF ORGANIC COLOR,
Florida Univ., Gainesville. Dept. of Chemistry.
A. P. Black, and D. G. Willems.
Journal of the American Water Works Association, Vol 53, No 5, p 589-604, May 1961. 16 fig, 1 tab, 16 ref.

Descriptors: *Water treatment, *Color, *Electrophoresis, *Coagulation, *Zeta potential.
Identifiers: Aluminum sulfate, Ferric sulfate.

Water from two creeks, both having high concentrations of organic color (270 and 225 ppm respectively) were used to study change in mobility of floc particles during coagulation. Electrophoretic measurements show that optimum coagulation and color removal, with both alum and ferric sulfate, were accompanied by reversal of the zeta potential of floc particles from negative to positive and that, within the pH zone of good coagulation, the zeta potential of floc particles, whether negative or positive, was quite low. The pH zone of good coagulation with ferric sulfate was substantially lower than the corresponding pH zone of good coagulation with alum. Two mechanisms of coagulation are suggested. (1) Positively charged colloidal micelles-chemically basic sulfates of the respective salts (alum or iron)-are formed. These positively charged hydrosols reduce or neutralize the negative charge on colloidal particles of color or turbidity, resulting in primary or electrokinetic coagulation. (2) For coagulation of turbid water, the primary or electrokinetic phase consists of two types of interaction, operating simultaneously. First is the adsorption of trivalent aluminum or ferric ions into the lattice structure of the clay particle by ion exchange, resulting in a reduction in the negative zeta potential of the clay particles. The second is further reduction of the zeta potential of the particles by the positively charged hydrolysis products of the coagulant. (Bean-AWWA)
W72-03698

IMPROVED OPERATION OF FOUR TREATMENT PLANTS AT DETROIT,
Detroit Dept. of Water Supply, Mich. Water and Sewage Treatment.
A. M. Shannon.
Journal of the American Water Works Association, Vol 53, No 12, p 1509-1516, December 1961. 1 fig, 2 tab.

Descriptors: *Water treatment, *Turbidity, *Mixing, *Flocculation, *Sedimentation, Cities, *Treatment facilities.
Identifiers: *Aluminum sulfate.

Two plants not equipped with mechanical mixing produced unsatisfactory flocculation, and settling of only 36 and 45% of turbidity. Moving the alum-dosing point and use of new diffusers resulted in increased removal to 55 and 70% of turbidity respectively. Further improvements in the first of these plants are being studied. A third plant was equipped with mixing basins and flocculation chambers. Alum was added to transition chambers some distance ahead of the mixing basins. Studies showed that floc was forming before reaching the rapid mixers, which acted to break the floc, some of which settled before reaching the flocculators. Moving the alum dosing point to the entrance of the rapid-mix basins resulted in increase of settling from 55 to 75% of turbidity. Reduced alum dosages resulted in each case. An addition to the old Springwells Plant (180 mgd) removed 92% of turbidity, producing a settled water of 0.8 Jtu. This addition was equipped with rapid mix chambers and flocculators. This plant was designed for recirculation and reuse of the waste wash water from both the old and new plants. Definitely increased filter runs result when the wash water is recirculated. (Bean-AWWA)
W72-03699

DETERGENTS AND OTHER CONTAMINANTS IN WATER SUPPLIES-1960,
Chicago South District Filtration Plant, Ill.
For primary bibliographic entry see Field 05A.
W72-03700

ZETA POTENTIAL AND ITS APPLICATION TO DIFFICULT WATERS,
Riddick (Thomas M.) and Associates, New York.
T. M. Riddick.
Journal of the American Water Works Association, Vol 53, No 8, p 1007-1030, August 1961. 16 fig, 11 ref.

Descriptors: *Water treatment, *Zeta potential, *Coagulation, *Flocculation, Colloids, Turbidity, Treatment facilities, New York.

Zeta potential is a measure of the electrokinetic charge that surrounds suspended particulate matter. The charge on raw-water turbidity is predominantly electronegative, and creates significant repulsion. If these charges are reduced to near zero, repulsive forces are eliminated. Gentle agitation than may create collisions, and the forces of adhesion, cohesion and mechanical interlocking will result in agglomeration. The nature of raw water colids and fundamental aspects of water treatment such as coagulation and stages of flocculation are reviewed. The nature of zeta potential, its variations on colloidal particles, zeta potential control, and the determination of electrophoretic mobility and zeta potential are discussed. Zeta potential control at the Waterford N.Y. plant is described. Hypothesis on course turbidity and colloid removal is discussed. (Bean-AWWA)
W72-03702

SAND FILTRATION OF ALGAL SUSPENSIONS,
Michigan Univ., Ann Arbor. Dept. of Sanitary Engineering.
J. A. Borchardt, and C. R. O'Melia.
Journal of the American Water Works Association, Vol 53, No 12, p 1493-1502, December 1961. 6 fig, 3 tab, 10 ref.

Descriptors: *Water treatment, *Algae, *Filtration, Head loss, Filters, *Scenedesmus, Flocculation, Water pollution treatment.

Filtration of both algal and flocculent particles through sand beds was tested. Eight-foot plexiglass filters with inside diameter of 3 3/8 in were utilized with Ottawa sand divided in three fractions, graded by microscopic measurements. All runs were made after tapping the filters to produce porosity of 40%. Algae of genera Scenedesmus, Ankistrodesmus and Anabaena were cultured with inorganic salts, aerated and temperature controlled. Head losses throughout the beds were determined by 7 piezometer tubes, and algae samples were counted with an electronic particle counter. Minimum removal efficiencies of 33, 22 and 10% were produced by the three sand sizes 0.316, 0.397, and 0.524 mm respectively. Removal of the stringy Anabaena consistently was higher than of the smaller more compact Ankistrodesmus. Algal removal in every case decreased with time to a constant minimum value. Significant numbers of algae were found in every sample throughout the research. Head loss increase was linear with time throughout the greater part of each run. Functionally, the behavior of the filter bed is the same in the removal of either flocculant or non-flocculant particles. Some surface straining takes place followed by continuous uniform removal with depth. The presence of flocculent material assists in the entrapment of algae cells, therefore multiple additions of chemicals and controlled flocculation may be more important than sedimentation capacity. Addition of chemicals to the filter influent might be best. (Bean-AWWA)
W72-03703

EXPERIENCE WITH ANTHRACITE-SAND FILTERS,
General Electric Co., Richland, Wash.
W. R. Conley.
Journal of the American Water Works Association, Vol 53, No 12, p 1473-1483, December 1961. 3 tab 6 ref.

Descriptors: *Water treatment, *Filtration, *Design, *Electrolytes, *Head loss, Flow rates, *Filters, Treatment facilities.
Identifiers: *Activated silica, *Dual-media filters, Coagulant aid, Backwashing, Filter media.

The ability of six main filter types to produce high-quality water at high rates and with long filter runs was measured. Filters made of 6 in of 0.43 mm effective-size sand and 24 in of 0.9 mm effective-size anthracite were superior to the other types. One plant operated at 8 gpm/sq ft. Air binding limited greater flow rates. Backwash water is usually below 2% and often 1% of gross output. A coarse-grained filter medium with a relatively high alum feed will produce a filtrate as clear as that produced by a fine-grained medium at a relatively low alum feed, until the filter breaks through. Breakthrough can be controlled if enough polyacrylamide or activated silica is fed to the water as it enters the filter. This causes improvement in quality but increase in head loss. Mixing of sand with anthracite to levels of several inches is mentioned. In discussion, Mr. Thomas R. Camp pointed out that anthracite, with a specific gravity of 1.4-1.6 must have a grain size of 2 to 3 times that of sand with specific gravity of 2.65 to be lifted equally at the same wash rate. Therefore to avoid mixing, the size of the bottom anthracite should be something less than three times the top size of sand. (Bean-AWWA)
W72-03704

THREE APPLICATIONS OF INSTRUMENTATION AND AUTOMATION,
American Water Works Service Co., Inc., Philadelphia, Pa.
E. H. Aldrich.
Journal of the American Water Works Association, Vol 53, No 11, p 1371-1386, Nov. 1961. 6 fig, 3 ref.

Descriptors: *Water treatment, *Instrumentation, *Automation, *Design, *Chemical analysis, Computers, Treatment facilities.
Identifiers: *Chemical application.

Instrumentation in itself does not provide automation, but it is usually an important element, providing the sensing and activating mechanism by which automation can be performed and controlled. Automation cannot take the place of judgement; it cannot think; it can perform many operations which can be scheduled for routine control relieving the operator for other tasks. Sensing units are now available for measuring residual chlorine, pH, oxidation-reduction potential, conductivity, alkalinity, fluoride, turbidity, color, hardness, and sludge densities. Complete automation may involve automatic analyzers and computers in the laboratory as well as mechanism for translating laboratory results into action in control of treatment procedure. The measurement and control of physical items such as pressure, temperature, levels and fluid flow are common throughout waterworks. The control of chemical features is developing. The application of instrumentation and automation in a booster station installation, in a well and storgae system and in a filtration and pumping plant are described. Several plants in which automated units of various kinds have been installed are listed. Some units are described, including automatic backwash operation, master control panel, and chemical feed panel. (In discussion of the paper, Mr. K. F. Knowlton, of Salem-Beverly, Mass., describes automatic control of dosing by various chemicals) (Bean-AWWA)
W72-03706

WATER QUALITY DEFINITIONS AND RESEARCH,
Geological Survey, Washington, D.C. Quality of Water Branch.
S. K. Love.
Journal of the American Water Works Association, Vol 53, No 11, p 1366-1370, Nov. 1961.

Descriptors: *Water treatment, *Water quality, *Public health, *Research, Water reuse, Biological processes, Aquatic life, Demineralization, Filtration, Taste, Odor, Corrosion.

Uses of the term 'water quality' in several fields is discussed, and the kinds of research studies being made to satisfy major interests are outlined. Quality of natural waters, water quality in public health, in industry, in agriculture and in wildlife management, and water reuse are discussed. Research should include geochemical research, study of what happens to radioactive wastes discharged underground, study of biologic processes in streams and lakes and plankton, and the role of aquatic organisms in the translocation of suspended and dissolved constituents. The most common means of purification of water, research on demineralization of water, the detergents industry's search for a 'soft' material, and the search for safe disposal of radioactive materials are described. Faster methods of determining filtrability of water are needed, also, improved methods for removing taste and odors and more efficient means of retarding corrosion and preventing incrustation of water mains. (Bean-AWWA)
W72-03707

CALCINATION TECHNIQUES,
Black and Associates, Inc., Gainesville, Fla.
W. B. Crow.
Journal of the American Water Works Association, Vol 52, No 3, p 322-326, March 1960. 2 fig, 1 tab, 7 ref.

Descriptors: *Water treatment, *Calcium carbonate, *Sludge, *Lime, Water softening, Hardness (Water).
Identifiers: Calcination, Kilns.

Recalcination of softening plant sludge is a process in which the sludge, concentrated in a centrifuge to at least 60 per cent solids, is burned at 2,000 F, the calcium carbonate and magnesium hydroxide present being converted to oxides. The carbon dioxide released is often used in the water treatment process. From each pound of quicklime used in treatment approximately 2.6 lb of calcium carbonate is usually obtained, from which 1.24 lb of lime is recovered by calcination, a production of 20-25 per cent excess lime. Principal factors affecting the economics of recalcination are discussed. The three principal systems for recalcination of softening sludge are: the rotary kiln, pellet-seeding calciner, and the flash calciner operation of the rotary kiln type and the pellet-seeding type are discussed, and some results of the latter at the Gainesville Ga. plant are noted. (Bean-AWWA)
W72-03716

ADVANCES IN WATER SUPPLY TECHNOLOGY,
Infilco, Tucson, Ariz.
A. A. Kalinske.
Journal of the American Water Works Association, Vol 52, No 2, p 199-204, Feb. 1960. 1 fig, 7 ref.

Descriptors: *Water treatment, *Research, *Standards, Solids contact processes, Mixing, Sedimentation, Flocculation, Electrolytes, Filters, Water reuse, Water purification.

Many processes have not changed much in fifty years. Reasons for the slow progress are: (1) Inadequate fundamental research in the universities and government laboratories. (2) Promulgation of old techniques and standards by regulatory agencies, and slowness of some of those charged with enforcement to accept new ideas, or even to provide means for the testing of new techniques and equipment. (3) Lack of enough interest, on the part of many consulting engineers, to study and look at new techniques and equipment until someone else has done the pioneering. The criticism is neither of conservatism nor engineering caution; rather, it is directed at the lack of a framework within which a new technique can be evaluated and the relying on someone else to try it first. Mentioned are the solids-contact process vs conventional mixing and sedimentation; the more effective turbine flocculation vs paddle mixing, chemical pretreatment with activated silica or polyelectrolytes, each of which should be studied individually; filter design, little changed in 40 years; hydraulics and airwash; and the greater role for desalinization and water reclamation. (Bean-AWWA)
W72-03717

MANGANESE REMOVAL BY OXIDATION WITH POTASSIUM PERMANGANATE,
Wilkinsburg-Pennsylvania Joint Water Authority.
R. B. Adams.
Journal of the American Water Works Association, Vol 52, No 2, p 219-228 Feb. 1960. 6 tab, 9 ref.

Descriptors: *Water purification, *Manganese, *Hydrogen ion concentration, *Oxidation, Chlorine, *Electrolytes, *Activated carbon, Filtration, Water treatement.
Identifiers: *Chlorine dioxide, *Potassium permanganate.

Complete manganese removal by increased pH required pH range of 9.4 - 9.6 and carbonate coating of sand grains resulted. Oxidation by chlorine dioxide required pH range of 8.5 - 9.0 but carbonate deposition and sand was excessive. The speed of reaction allowed about 65% of the manganese to be removed in the sedimentation basins. Potassium permanaganate rapidly oxidized manganese in pH range 7.2 - 8.3. oxidation was so rapid that the oxidized products are removed in the coagulation process. Theoretically for each 1.0 part of Mn++, 1.9 parts of KMn 04 would be required to produce oxidation. Use of prechlorination to 0.3 - 1.0 ppm total available chlorine allows use in the plant of 1.0 - 1.2 ppm permanganate for each parts of soluble manganese in the raw water. Filterability of electrolyte treated water results in longer filter runs, and no additional cost, because of reduction in alum required. Activated silica was used four years but changed to Hagan HCA = 18 - polyelectrolyte when it became available about 1957, primarily because of ease of handling and feeding. (bean-AWWA)
W72-03718

EVALUATION OF LABORATORY METHODS FOR ANALYSIS OF HEAVY METALS IN WATER,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
For primary bibliographic entry see Field 05A.
W72-03719

EFFECTS OF ACCUMULATED LIME-SOFTENING SLURRY ON MAGNESIUM REDUCTION,
Saint Louis County Water Co., University City, Mo.
J. L. Tuepker, and H. O. Hartung.
Journal of the American Water Works Association, Vol 52, No 1, p 106-116, January 1960. 6 fig, 6 tab, 13 ref.

Descriptors: *Water treatment, *Magnesium, *Calcium, *Water softening, Hardness (Water).
Identifiers: *Lime slurry.

Magnesium as well ad calcium precipitation by lime softening is increased when the softening occurs in the presence of accumulated softening slurry. Magnesium concentration remaining will not precipitate in 140 F water heaters and will not require recarbonation. Slurry concentration should be about 5 per cent and virtually free of activated silica, coagulant or turbidity. A mixing time of about 30 minutes for contact is required. Lime dosage required should not exceed the raw-water alkalinity plus 34 ppm. A greater quantity of suspended softening solids is required for improved magnesium precipitation than for improved calcium precipitation. (Bean-AWWA)
W72-03722

ADVANCES IN THE USE OF FLUOSPAR FOR FLUORIDATION,
Public Health Service, Washington, D.C.
F. J. Maier.
Journal of the American Water Works Association, Vol 52, No 1, p 97-105, Jan 1960. 3 fig, 1 tab, 3 ref.

Descriptors: *Water treatment, *Fluoridation, Public health, Maryland, Water purification.
Identifiers: *Fluospar, Bel Air (Md).

More than 34,000,000 persons in the U.S. are using artifically fluoridated water. Fluorspar is the principal source of commercial fluoride, the commercial grades containing 85-98% calcium fluoride. Most economical treatment is by dissolving fluospar at the treatment plant in alum solution. Vigorous stirring is required for about 2 hours. (Fluospar is also the principal raw material in the manufacture of various fluorides.) Process, and application, of fluorspar at the Bel Air, Md. waterplant is described; also suitability for larger plants is discussed, and suitable design of units for large plant is indicated. (Bean-AWWA)
W72-03724

STUDY OF SHORT FILTER RUNS WITH LAKE MICHIGAN WATER,
Public Health Service, Chicago, Ill.
M. B. Gamet, and J. M. Redemacher.
Journal of the American Water Works Association, Vol 52, no 1, p 137-152, Jan 1960. 4 fig, 6 tab, 5 ref.

Descriptors: *Water purification, *Water treatment, *Filtration, Flocculation, Sedimentation, *Electrolytes, Sulfates.
Identifiers: *Ferrous sulfate, Alum.

Selected data and analyses are presented from a study of short filter runs on Lake Michigan water in 12 filter plants, 37 percent of all runs being less than 20 hours. The most significant organism exhibiting filter clogging tendencies was Tabellaria. Turbidity of settled water not a significant factor. Adequate flocculation and sedimentation shown to be needed, throughout all ranges up to design capacity. Marked increases in filter runs were experienced (in one plant) when ferrous sulfate was substituted for alum. Need of a satisfactory quantitative treatment index to replace the qualitative measurements now in use is demonstrated. The use of polyelectrolytes should be more thoroughly investigated as supplementary treatment during short filter run periods. (Bean-AWWA)
W72-03726

PHYSIOLOGICAL AND HEALTH ASPECTS OF WATER QUALITY.
American Water Works Association, N.Y. Task Group 2760P.

Journal of the American Water Works Association, Vol. 53, No.11, p.1354-1360, November 1961. 24 ref.

Descriptors: *Water purification, *Public health, *Standards, *Physiological ecology, *Viruses, *Organic matter, *Toxicity, Pesticides, Insecticides, Water quality.

Concentration limits for seven items were added to the 1961 Drinking Water Standards (not included in the 1946 edition) but other impurities were not mentioned because their physiologic and health aspects are not known. An increasing field of new pollutants cannot be totally excluded from water supplies and must be removed in water treatment. The actual hazard of some viruses, organic contaminants, insecticides and pesticides, and certain heavy metals are unknown. There is lack of knowledge from which limiting criteria may be set regarding some potentially toxic chemicals or excessive amounts of some common minerals. The physiologic effects of consuming, over a long time, many potentially toxic materials are not known. Many chemical constituents such as those composing Carbon chloroform extract have never been identified. Development of improved technology for water quality control should be accepted as a challenge by the scientist and engineer both in and outside the water utility field. (Bean-AWWA)
W72-03745

ALGAE AND OTHER INTERFERENCE ORGANISMS IN WATER SUPPLIES OF CALIFORNIA,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
For primary bibliographic entry see Field 05A.
W72-03746

ACTIVATED CARBON FOR TREATMENT OF CONDITIONS ATTRIBUTED TO SYNTHETIC DETERGENTS,
West Virginia Pulp and Paper Co., New York. Industrial Chemical Sales Div.
E. A. Sigworth.
Journal of the American Water Works Association, Vol. 53, No 8, p 1003-1006, August 1961. 1 tab, 1 ref.

Descriptors: *Water treatment, *Detergents, *Taste, *Foaming, *Activated Carbon, *Water pollution treatment, Water purification, Alkybeazene sulfonates.

Synthetic detergent sales equal 3.6 billion pounds per year. Alkyl benzene sulfonate is most widely used in house-hold detergents and is responsible for the foaming tendency. It constitutes 10 to 35% of the total formulation; the remainder consists of builders which may be plain water, phosphates, sulfates, or other compounds. None of the compounds are considered toxic to humans in the concentrations likely to be present in a water supply; therefore synthetic detergents cannot be construed as a health hazard. Foam and flavor are the problems. Activatedc carbon can control both foam and flavor with plant dosages of 1 to 2 ppm of carbon per 1ppm of detergent. Cost of control therefore is not excessive. It is suggested that plants facing a potential synthetic detergent problem provide feeding capacity for up to 50 ppm of activated carbon, at maximum capacity. The problem is most apt to occur in dry weather when stream flows are low and water demands are at maximum. (Bean - AWWA)
W72-03748

ELECTROPHORETIC STUDIES OF SLUDGE PARTICLES PRODUCED IN LIME-SODA SOFTENING,
Florida Univ., Gainesville. Dept. of Chemistry.
A. P. Black, and R. F. Christman.
Journal of the American Water Works Association, Vol 53, No. 6, p.737-747, June 1961. 8 fig., 7 tab., 14 ref.

Descriptors: *Water treatment, *Water softening, *Electrophoresis, *Sludge, *Zeta potential, *Electrolytes, Calcium carbonate, Magnesium hydroxide, Lime, Sodium compounds.
Identifiers: Coagulant aid.

Zeta potential of Mg (OH)2 was positive throughout entire pH range of lime-soda softening. CaCO3 was negative in the absence of magnesium, but became less negative and finally positive with increasing ratio of magnesium to calcium. Zeta potential of CaCO3 particles was also reversed to positive values when MgCl2 was added after softening. Multivalent ions will affect the zeta potential of floc particles. Anionic aids were found to increase the negative zeta potential of CaCO3 floc particles, whereas cationic aids had the opposite effect, reducing and finally reversing the zeta potential of CaCO3 particles from negative to positive. A nonionic aid had no effect on particle mobility and little effect on coagulation and settling. (Bean-AWWA)
W72-03756

TEST PROGRAM FOR FILTER EVALUATION AT HANFORD,
General Electric Co., Richland, Wash.
W. R. Conley, and R. W. Pitman.
Journal of the American Water Works Association, Vol. 52, No. 2, pp.205-214, Feb. 1960. 3 figs., 7 tabs., 2 refs.

Descriptors: *Water purification, *Filtration, *Filters, Sands, Washington, Turbidity.
Identifiers: Anthracite, Dual-media filters, Hanford (Wash).

A filter evaluation program is reported conducted at Hanford, Washington by using various laboratory filters, with sand, anthracite and combinations of the two filter media. Sand alone or anthracite alone did not meet criteria desired but the two together did meet criteria. The best combination found was 8 in. of 30-40 mesh sand and 22 inc. of 6-18 mesh anthracite. Data were obtained at 2 to 35 gpm/sq. ft. The upper limit for Columbia River water was nearly 10 gpm/sq. ft. Extremely low turbidity readings were reported, however, these were not correlated with the standard Jackson (Jtu) units. (Bean - AWWA)
W72-03759

MECHANICAL AERATION SYSTEMS FOR RIVERS AND PONDS,
Littleton Research and Engineering Corp., Mass.
For primary bibliographic entry see Field 05G.
W72-03781

DENTAL CARIES PREVALENCE IN 5-YEAR-OLD CHILDREN FOLLOWING FIVE AND A HALF YEARS OF WATER FLUORIDATION IN BIRMINGHAM,
Birmingham Univ. (England). Dept. of Dental Health.
J. F. Beal, and P. M. C. James.
Brit Dent J. 130 (7): 284-288. Illus. 1971.
Identifiers: Birmingham, Caries, Children, Dental, England, Fluoridation, Old, Prevalence, Years.

Children from 2 areas of the city showed significant reductions in their dental caries experience. A control group of children consuming unfluoridated water maintained a fairly constant level of dental caries prevalence over the same period. The problems in the interpretation of dental caries reductions due to fluoride in different age groups are discussed.--Copyright 1971, Biological Abstracts, Inc.
W72-03820

QUALITY IMPROVEMENTS RESULTING FROM INDUSTRIAL NEEDS AT HOPEWELL,
Old Dominion Water Corp., Hopewell, Va.
E. F. Eld, and M. E. Flentje.
Journal of the American Water Works Association, Vol 53, No 3, p 283-287, March 1961. 2 tab.

Descriptors: *Water treatment, *Iron, *Maganese, *Color, *Coagulation, Chlorination, Lime, Instrumentation, Hydrogen iron concentration, Odor, Activated carbon, Water quality, *Industrial water.

A plant producing nitrocellulose of premium grade uses almost 25 mgd. A water quality more stringent than most public supplies was needed. Desired quality values were maximums on iron and manganese 0.02 and 0.005 ppm respectively, color maximum 1, plug point of 4 in. diam. standard glass fiber filter minimum of 200 gals at 50 psi. Quality desired was produced after adoption of a program consisting of prechlorination to 4 ppm free residual, lime application for pH of 6.2., alum coagulation aided by activated silica, lime to increase pH on top of filters to 8.2-8.4, post-chlorination, or dechlorination with sulfur dioxide as required, final pH correction with lime if needed, and development of laboratory and plant recording instruments for control. In recent years the water plant has been plagued with odor which is treated with activated carbon. Serious consideration is being given to installation of carbon filters for domestic service only. (Bean-AWWA)
W72-03822

VIRUSES, AMEBAS AND NEMATODES AND PUBLIC WATER SUPPLIES,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
S. L. Chang.
Journal of the American Water Works Association, Vol. 53, No. 3, p 288-296, March 1961. 23 ref.

Descriptors: *Water treatment, *Water quality, *Viruses, *Nematodes, *Salmonella, *Shigella, *Diseases, *Chlorination, Filtration, Public health.

Various viruses and their roles in outbreaks of infectious hepatitis, poliomyelitis etc. are discussed, also the endameba histolytica and free living amoebas. Knowledge regarding nematodes is reviewed, starting with Cobbs' finding them in great numbers in slow sand filters. They have been found in most slow sand filters tested, but few are found in rapid filters. The nematodes themselves have no health significance, but they are capable of ingesting Salmonella and Shigella, and the ingested pathogens may survive even after the nematodes have been immobilized. The most practical method for preventing nematode infestation is to prechlorinate raw water to a free residual of 0.4-0.5 ppm for 6 hr. Although many nematodes may not be killed, they are sufficiently affected that they cannot swim, therefore, they settle out in the flocculation process. (Bean-AWWA)
W72-03823

REMOVAL OF ALGAE BY MICROSTRAINERS,
Ontario Water Resources Commission, Toronto (Ontario).
A. E. Berry.
Journal of the American Water Works Association, Vol 53, No 12, p 1503-1508, December 1961. 2 ref.

Descriptors: *Water treatment, *Algae, Filtration, *Slime, *Ultraviolet radiation, *Treatment facilities, Filters.
Identifiers: *Microstrainers, Hypochlorites.

Microstrainers may serve as the sole filtration process, as treatment ahead of both slow and rapid sand filters, or as filters of sewage and industrial effluents after treatment. They are used on drinking water and industrial water. Selection of microstrainer must be related to efficiencies in removal of algae and economics in comparison with other methods of treatment. Selection of appropriate units and design of the installation must be related to the filterability index of the water for selection of fabric, and maximum capacity is dependent on maximum submergence. In the United States 12 installations are reported in use. In Canada 15 installations are in use or will be shortly. Of these, 13 are serving as the only treatment apart from disinfection and two are used ahead of rapid sand filters. Some difficulties have arisen. Some units had inadequate means of controlling the head loss through the fabric, which was damaged. Washwater pressures were not effectively controlled, sliming and binding of the fabrics required treatment with sodium hypochlorite or other chemicals and it has been found desirable to equip all units with ultra-violet lights and to operate them continuously. Blinding of the fabric has been encountered from some cause other than slimes. The cause remains to be determined. (Bean-AWWA)
W72-03824

ELECTROPHORETIC STUDIES OF TURBIDITY REMOVAL BY COAGULATION WITH ALUMINUM SULFATE,
Florida Univ., Gainesville. Dept. of Chemistry.
A. P. Black, and S. A. Hannah.
Journal of the American Water Works Association, Vol 53, No 4, p 438-452, April 1961. 9 fig, 2 tab, 21 ref.

Descriptors: *Water treatment, *Electrophoresis, *Electrolytes, *Clays, *Turbidity, *Coagulation, *Zeta potential, Hydrogen ion concentration.
Identifiers: Aluminum sulfate, Coagulant aid.

The relationship of particle zeta potential and coagulation in dilute clay suspensions was investigated as alum dosage and pH were varied. In addition, the effects of polyelectrolyte coagulant aids on zeta potential and on coagulation were determined. The polyelectrolyte series utilize eight coagulant aids, including six commercial products, starch and caustic starch. An amount of alum equivalent to several times the base-exchange capacity of the clay suspension was required to neutralize the particle charge. Clarification was best in the range pH 7.5-8.5 where the particles were negative, rather than at pH values where the particle charge had been neutralized. All eight coagulant aids used with alum, could be made to improve or inhibit coagulation by selection of dosages of alum and aid. As in the coagulation at different pH values, final particle charges could not be correlated with residual turbidities. (Bean-AWWA)
W72-03826

EFFECT OF FISH POISONS ON WATER SUPPLIES, PART 2 - ODOR PROBLEMS,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
For primary bibliographic entry see Field 05C.
W72-03828

TREATMENT APPLICATION POINTS FOR ACTIVATED CARBON,
West Virginia Pulp and Paper Co., Tyrone, Pa.
A. Y. Hynshaw.
Journal of the American Water Works Association, Vol 54, No 1, p 91-98, January 1962. 4 fig, 5 tab, 12 ref.

Descriptors: *Water treatment, *Activated carbon, *Taste, *Odor, *Phenols, *Viruses, *Toxicity, *Organic matter, *Coagulation.

The effects of activated carbon application are not only taste and odor control; it will increase the sparkle of water, remove viruses, absorb herbicides, insecticides, and detergents, improve coagulation and reduce the chlorine demand of the water. Adsorption of some compounds, such as phenol, is difficult at pH values greater than 8 but easy below that value. At Fort Wayne, 40 ppm carbon did not seem to change the odor when applied with the softening chemicals, but when the carbon was applied to the raw water a palatable water resulted. The carbon should be applied at a point where maximum adsorption conditions prevail. In general less carbon will produce a palatable water when applied before chlorination rather than after chlorination. Selection of the point of applying carbon should be studied for maximum efficiency of plant operation. In an emergency it may be applied at several points, particularly at filter entrance. (Bean-AWWA)
W72-03829

REMOVAL OF ABS FROM WATER BY CHLORIDE ANION EXCHANGE,
Diamond Alkali Co., Redwood City, Calif. Western Div.
I. M. Abrams, and S. M. Lewon.
Journal of the American Water Works Association, Vol 54, No 5, p 537-543, May 1962. 3 fig, 1 tab, 9 ref.

Descriptors: *Water treatment, *Organic matter, *Detergents, *Resins, *Ion exchange, *Water pollution treatment, *Alkylbenzene sulfonate.

Alkylbenzene sulfonate (ABS) was more effectively removed with chloride form resins than with hydroxide forms. Columnar anion exchange offers a convenient method for removing ABS from water or clarified waste. Low concentrations of ABS, such as are found in surface water, are effectively removed by Resin S in the chloride form. This strongly basic anion exchanger, in a column, can remove as much as 350 g/l of resin. The ABS can be eluted from the resin by a combination of a mineral acid and a polar solvent. (Bean-AWWA)
W72-03830

EFFECT OF FISH POISONS ON WATER SUPPLIES, PART 3 - FIELD STUDY AT DICKINSON,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
For primary bibliographic entry see Field 05C.
W72-03831

STATUS OF FLUORIDATION IN THE UNITED STATES AND CANADA, 1960.
American Water Works Association, New York. Task Group 2620P.

Journal of the American Water Works Association, Vol 54, No 5, p 559-578, May 1962. 3 fig, 8 tab.

Descriptors: *Water treatment, *Fluoridation, *Fluorides, United States, Puerto Rico, Water quality.
Identifiers: Canada.

During 1960, 128 U.S. communities served by 98 water systems initiated fluoridation. The population served (military and civilian) in U.S. totals 41,169,412, living in 2,111 communities, served by 1,172 suppliers. In addition over 7,300,000 people are using water that naturally contains 0.7 mg/l or more of fluoride. Total population using fluoridated water therefore exceeds 48 million, representing about 36% of people using public water supplies. 60 Canadian water supplies serve fluoridated water to 1,361,626 people living in 82 communities. In Puerto Rico 93% of the people using public water supplies receive fluoridated water. This is undoubtedly the highest proportion in the world of people receiving this benefit. During 1960 no new communities selected either ammonium silicofluoride or fluospar for fluoridation. Hydrofluosilicic acid was used by eight new water supplies. There were no serious shortages of any fluoride compound. (Bean-AWWA)
W72-03832

EFFECTIVENESS OF WATER TREATMENT PROCESSES IN VIRUS REMOVAL,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
G. G. Robeck, N. E. Clark, and K. A. Dostal.
Journal of the American Water Works Association, Vol 54, No 10, p 1275-1292, Oct 1962. 1 fig, 5 tab, 17 ref.

Descriptors: *Water treatment, *Public health, Filtration, *Viruses, *Diseases, Flocculation, Sedimentation, Flow rates, Sanitary engineering, *Water pollution treatment.

Small-scale pilot plants were used to study the removal of poliovirus Type I from water as it passed through unsaturated or water-saturated sand at ground water movement rates and through a flocculation-filtration process at rapid rates. The plaque technique was used in all virus assays; this technique allows viruses to be counted with about the same accuracy as is achieved with bacterial plate counts. Two feet of clean, well-packed sand removed poliovirus from water flowing at less than 4 ft. per day, and the percentage decreased, with increased rates, until most of the organisms went through at rapid filtration rates. If a low but well-mixed dose of alum was fed just ahead of filters operated at 6 or 2 gpm /sq. ft., more than 98% of the viruses were removed on 16 in. of coarse coal on 8 in. of sand. With increased alum dose and conventional flocculators and settling, removal increased to 99%. (Bean-AWWA)
W72-03833

HIGH-QUALITY WATER PRODUCTION AND VIRAL DISEASE,
Hazen and Sawyer, New York.
H. E. Hudson, Jr.
Journal of the American Water Works Association, Vol 54, No 10, p 1265-1274, October 1962. 3 fig, 4 tab, 18 ref.

Descriptors: *Water treatment, *Public health, *Water quality, *Quality control, *Diseases, *Bacteria, *Viruses, Microorganisms, Turbidity, Manganese.

The treatment of water and quality of tap water in numerous cities were compared with hepatitis incidence. Filtration plants operated to attain a high degree of removal of one impurity tend to accomplish high removals of other suspended materials. Examples of parallelism in removal of turbidity, manganese, microorganisms and bacteria are cited. Plants producing very clear water also tend to secure low bacterial counts accompanied by low incidence of viral disease. The production of high-quality water required striving toward high goals as measured by several criteria. These criteria include turbidity, bacteria, and coliform counts and thorough chlorination. The operating data for plants treating polluted water indicate that low virus disease rates occur in cities where the water treatment operators aim to produce a superior product rather than a tolerable water. (Bean-AWWA)
W72-03834

BACTERICIDAL EFFECT OF LOW CONCENTRATIONS OF SILVER,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
C. W. Chambers, C. M. Proctor, and P. W. Kabler.
Journal of the American Water Works Association, Vol 54, No 2, p 208-216, Feb 1962. 1 fig, 9 tab, 11 ref.

Descriptors: *Water treatment, *Disinfection, *Bactercides, Phosphates, Light intensity, Hydrogen ion concentrations.
Identifiers: *Silver.

The effects of phosphates, pH, light, cell concentration, and type of silver on the bactericidal action of silver was investigated. Germicidal action was related to the concentration of silver ions rather than to the physical nature of the silver from which the ions were originally derived. Neither presence or absence of light, nor change in density of test organisms, produced the discernible effect on the bactericidal action of silver. Phosphate tended to decrease germicidal efficiency, whereas increases in pH accelerated death rates. A mixture of sodium thiosulfate and sodium thioglycollate was most efficient as a neutralizer of bactercidal and bacteriostatic actions. (Bean-AWWA)
W72-03838

DESIGN CRITERIA FOR DIATOMITE FILTERS,
Johns-Manville Research and Engineering Center, Manville, N.J.
G. R. Bell.
Journal of the American Water Works Association, Vol 54, No 10, p 1241-1256, October 1962. 4 fig, 1 tab, 10 ref.

Descriptors: *Water treatment, *Design, *Filters, *Diatomaceous earth, *Water quality, Turbidity, Iron, Manganese, Organic matter, Color, Treatment facilities.
Identifiers: Filter aid, Diatomite filters.

Design criteria for any filter station must be built around the nature of the turbidity in the water supply and the requirements for finished water quality. Until such techniques as those advocated by Baumann and La Frenz have been perfected, the best means of providing design for specifications for particular water supplies will be through pilot filtration tests. Most diatomite filters to date have been installed primarily to clarify water supplies of substantially good quality. Recently there have been substantial advances in the technology. Iron and manganese now appear to be effectively removed in suitably designed systems. Specially processed filter aids have promise for removal of pollutants and gross contaminants previously beyond the safe operating limits of diatomite filters generally. Controlled preconditioning of the filter feed is used to increase effectiveness. The adsorptive filter aid is mixed with the filter feed and the whole premixed filter feed is then pumped to the filter. By such methods, processes for removal of certain organic contaminants, iron, manganese, and organic color in water supplies have considerable promise. Considerable progress has been made toward widening the applicability of diatomite filters. (Bean-AWWA)
W72-03916

OPERATING EXPERIENCES AT PHILADELPHIA SUBURBAN TREATMENT PLANTS,
Philadelphia Surburban Water Co., Bryn Mawr, Pa.
K. E. Shull.
Journal of the American Water Works Association, Vol 54, No 10, p 1232-1240, Oct 1962. 5 tab, 8 ref.

Descriptors: *Water treatment, *Filtration, *Wells, *Drought, *Manganese, *Iron, *Taste, *Odor, *Chlorine, *Activated carbon, Water quality.
Identifiers: *Chlorine dioxide, *Permanganate, Dual-media filters.

One of the world's largest privately owned water companies, Philadelphia Surburban, serves nearly 800,000 people in 49 municipalities in a territory of nearly 300 sq. miles. Management has a progressive attitude and in 1958 established a separate research department for improvement of existing methods and development of new and better ones. There are five principal surface supplies, with four impounding dams, the water is processed by three water treatment plants. Seven deep wells are also used. The effluent of all plants and wells is pumped into an interconnected and integrated system. Experiences during the drought of 1957 are described; one of the most severe problems was the high content of manganese and iron and odors in water from the depleted Geist Reservoir and in Crum Creek. Chlorine would remove the iron and odors; chlorine dioxide removed 95% of the manganese and most of the iron, but failed to remove the musty, woody tastes and odors. The latter were controlled by low free residual chlorination and activated carbon. Potassium permanganate in 2.5:1 ratio to manganese showed 92.5% reduction; also a significant reduction in odor. At Pickering, an average of 0.75 ppm potassium permanganate, with 3 ppm of carbon applied to water leaving the settling basin, produced the same threshold odor of 3 as resulted with carbon dosage of 12 ppm alone. (Bean-AWWA)
W72-03923

ANNUAL REPORT, 1969-1970.
Sacramento City Div. of Water and Sewers, Calif.
For primary bibliographic entry see Field 05D.
W72-03977

WATER AND SAN DIEGO COUNTY GROWTH.
Western Management Consultants, Inc., San Diego, Calif.
For primary bibliographic entry see Field 06D.
W72-03979

OPTIMUMS IN DIATOMITE FILTRATION,
Corps of Engineers, Washington, D.C.
R. L. La Frenz, and E. R. Baumann.
Journal of the American Water Works Association, Vol 54, No 7, p 847-851, July 1962. 5 fig, 1 ref.

Descriptors: *Water treatment, *Filtration, *Diatomaceous earth, *Flow rates, *Head loss.
Identifiers: *Diatomite filters, Coagulant aids, Filter aids.

To obtain maximum gallons of potable filtrate per pound of diatomite, the diatomite economy optimum body feed would be used. For a given water

and filter, this body feed is a function of the amount of precoat used and the terminal head loss. In general, the optimum body feed decreases with decreasing amounts of precoat and increasing terminal head losses. To obtain the maximum number of gallons filtrate per run to some terminal head loss, the head loss optimum body feed should be used. It is a function of the filter cake composition. This optimum occurs at much higher body feeds than the diatomite economy optimum. Lower rates of filtration produce more filtrate per run at a given terminal head loss. The overall optimum body feed, optimum filtration rate, and optimum terminal head loss combine to produce potable water at the minimum cost per gallon. These optimums are influenced by four cost factors: labor, power, diatomite and equipment. (Bean-AWWA)
W72-03999

POLYMER FLOCCULATION KINETICS OF DILUTE COLLOIDAL SUSPENSIONS,
California Inst. of Tech., Pasadena. W. M. Keck Lab. of Environmental Health Engineering.
F. B. Birkner, and J. J. Morgan.
Journal of the American Water Works Association, Vol 60, No 2, p 175-191, February 1968. 12 fig, 1 tab, 16 ref.

Descriptors: *Water treatment, *Colloids, *Electrolytes, *Coagulation, Sedimentation, Filtration.
Identifiers: *Destabilization.

Experiments conducted under turbulent flow conditions in a stirred-tank-type reactor demonstrated that the flocculation process is the rate-controlling step in polymer destabilization. At optimum polymer dosage, the apparent rate of decrease in total particle concentration can be represented by a first-order reaction equation. Particle aggregation proceeds at a faster rate when coagulation is induced by sodium chloride than when a polyelectrolyte is used. Also salt-coagulated systems appear to be more resistant to deflocculation than polymer-flocculated systems. Maximum particle removal efficiency occurred at the optimum polymer dosage, however, flocculation did proceed to a limited extent when either overdosed or underdosed polymer conditions prevailed. Particle removal efficiency was greater with the overdosed polymer condition than the underdosed condition only when the systems were subjected to intense agitation. When an insufficient amount of polymer was present, the extent of flocculation was severely restricted by the limited number of polymer bridges which could be formed. Comparison of optical density and total particle concentration on settled water revealed no obvious correlation between these two parameters, primarily because the optical properties are dependent on the size of particles as well as number. (Bean-AWWA)
W72-04000

PILOT PLANT STUDIES OF FLOC BLANKET CLARIFICATION,
Water Research Association, Marlow (England). Plant Process Div.
D. G. Miller, and J. T. West.
Journal of the American Water Works Association, Vol 60, No 2, p 154-164, February 1968. 10 fig, 9 ref.

Descriptors: *Water treatment, *Sludge, *Electrolytes, *Turbidity, *Flow rates, Hydrogen ion concentration, Aluminum, Iron compounds, Flocculation, Pilot plants.
Identifiers: *Sludge blanket, *United Kingdom.

Whereas the horizontal system with preflocculation facilities is widely used in the U.S., the horizontal tank is fast disappearing from the water utilities of the United Kingdom. These have a poor reputation in British practice, largely because inadequate preflocculation facilities have been provided. In pilot plant studies of floc blanket clarifiers, blankets with aluminum and iron coagulants, at rising velocities up to 20 ft/hr were maintained. As expected, the floc carryover increased as velocity increased resulting in higher filter loading, reflected by increased Al or Fe content, turbidity of settled water and decreased length of filter runs. Increased blanket depths were found to improve separation efficiency of both iron and aluminum systems. Effects of polyelectrolytes on the floc blanket efficiency are being studied. With increased turbidity values aluminum dosages steadily decreased, although Al content increased, and filter runs increased. With iron dosages increased, both turbidity and iron content decreased and filter runs increased. Optimum pH for aluminum was 6.5 to 7.0. Ferric chloride showed less dependence on pH; the indicated optimum was about 1 pH unit lower than for aluminum. The results strongly suggest that there is room for improving the performance of existing clarifiers, as well as for improved designs based on a better understanding of basic system behavior. (Bean-AWWA)
W72-04001

VIRUS CONTROL AT THE SANTEE, CALIF. PROJECT,
Federal Water Pollution Control Administration, Alameda, Calif. Central Pacific River Basins Project.
J. C. Merrell, and P. C. Ward.
Journal of the American Water Works Association, Vol 60, No 2, p 145-153, February 1968. 2 fig, 5 tab, 6 ref.

Descriptors: *Waste water treatment, *Reclaimed water, *Recreation, *Viruses, *Oxidation, *Lagoons, *Percolation, Groundwater recharge, Swimming, California, Water reuse.
Identifiers: San Diego (Calif).

Since 1961 the Santee County Water District has supplied reclaimed water for use in recreational lakes and as a source of raw water for a flow-through swimming basin. Programs for the control of virus contamination have been effective; the most efficient bactericidal and viricidal treatment was provided by the oxidation pond and percolation zone. These units cannot be bypassed in the chain of treatment, thus providing safety. The waters supplied to the swimming area were further treated by coagulation, filtration, and heavy chlorination; no virus was found nor any epidemiological evidence of illness. No virus was found in the recreation lake waters, which did not receive these treatments. Exceptional degree of experience and training necessary for laboratory personnel is noted, also the high costs of processing samples (more than $200 each), and the need for a further step for control, namely quantitation of the viruses. (Bean-AWWA)
W72-04002

IODINE FOR THE DISINFECTION OF WATER,
Florida Univ., Gainesville.
A. P. Black, W. C. Thomas, Jr., R. N. Kinman, W. P. Bonner, and M. A. Kein.
Journal of the American Water Works Association, Vol 60, No 1, p 69-83, January 1968. 9 fig, 6 tab, 15 ref.

Descriptors: *Water treatment, *Water purification, *Disinfection, *Potassium compounds, Taste, Odor, Hydrogen ion concentration, Florida, Halogens.
Identifiers: *Iodine, Gainesville (Fla), Lowell (Fla).

Iodine may be applied to a municipal water supply by (a) vaporizing through accurately controlled heat input, (b) as saturated solution prepared by slowly passing water through a bed of crystalline iodine (c) employing an excess of an oxidant such as chloramine to oxidize the iodide ion (I-1) to HIO. Three years satisfactory experience in application of iodine by method b to the water supplies of three institutions is reviewed. A trial application of iodine by method c to the Gainesville water system is described. This system has 185 mi of mains greater than 4 in. in diameter. The water supply is drawn from two aquifers, one 407 to 461 ft deep and the other 713 to 872 ft deep. Persistence of the halogen in various pipes is reported. Freedom from tastes or odors in previous usages is noted. A solution containing 5 lb/gal of potassium iodide was used, with a small feed pump. Dosage was adjusted to provide a residual of 1 ppm of HIO, expressed as iodine. It was applied in the flume between the recarbonation basin and the sand filters, chosen because of the lower pH 98.6) of the water and the fact that most of the chlorine exists as the chloramine; both factors minimizing the possibility of forming iodate. Iodination was terminated after 12 hrs due to the immediate presence of an objectionable taste and odor. This had not been predicted by laboratory test. (Bean-AWWA)
W72-04003

COAGULATION OF COLLOIDAL HYDROUS MANGANESE DIOXIDE,
Carus Chemical Co., LaSalle, Ill.
H. S. Posselt, A. H. Reidies, and W. J. Weber, Jr.
Journal of the American Water Works Association, Vol 60, No 1, p 48-68, January 1968. 16 fig, 14 ref.

Descriptors: *Water treatment, *Manganese, *Coagulation, *Flocculation, *Sedimentation, *Colloids, Viscosity, Aluminum, Iron compounds, Zeta potential, Hydrogen ion concentration, Electrolytes.
Identifiers: *Destabilization, Polyelectrolytes.

Coagulation of hydrous Mn02 with aluminum sulfate and ferric sulfate, surface characteristics of the oxide as colloidal stability, its sorption of metals and its destabilization, are described. Destabilization of colloidal manganese dioxide was readily effected by calcium ion over a wide range of pH. Relatively small dosages of Ca are effective in reducing dosages of cationic polyelectrolyte required for destabilization, they also enhance coagulation with Fe and Al in waters of high pH. The action of Ca is explained as an exchange sorption of the Ca ions at the hydrous Mn02 surfaces. Ca, by itself, does not cause charge reversal and subsequent restabilization, even at very high dosages. When cationic polymers are used as primary coagulants, increased dosage ultimately leads to charge reversal and subsequent restabilization. The increment between destabilization and restabilization can be relatively narrow. Temperature has little or no effect upon the optimum dosage for coagulation of hydrous Mn02 with iron or aluminum, but it does influence the growth of floc and its sedimentation, probably as a result of viscosity effects. (Bean-AWWA)
W72-04004

COAGULATION CONTROL,
Neptune Microfloc, Inc., Corvallis, Oreg.
W. R. Conley, and R. H. Evers.
Journal of the American Water Works Association Vol 60, No 2, p 165-174, February 1968. 5 fig, 4 tab, 6 ref.

Descriptors: *Water treatment, *Coagulation, *Filters, Filtration, *Automatic control, Turbidity, *Monitoring, Oregon.
Identifiers: *Jar Tests, *Pilot filters, Mill City (Ore).

The automatic coagulation control system in use at a 1-mgd water treatment plant at Mill City, Oregon is described. Of the methods of monitoring coagulation in use today (electrophoresis, jar tests, streaming current, and pilot filters), only the pilot filter system measures directly the variable of interest to the plant - the filtered water turbidity. The pilot system provides early warning of improper coagulation conditions. It allows quick and accurate evaluation of coagulant dosage changes. Coagulation control can be maintained even under rapidly changing raw water conditions. Chemical

dosages can be optimized and, therefore, treatment costs minimized for the production of plant waters with desired effluent clarity. The use of the pilot filter system to control coagulant and related chemical dosages brings full automatic control of water plant operation closer to reality. One plant has been operating for more than a year. (Bean-AWWA)
W72-04005

CHEMICAL INTERACTION OF DISSOLVED SILICA WITH IRON (II) AND (III),
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
J. E. Schenk, and W. J. Weber, Jr.
Journal of the American Water Works Association, Vol 60, No 2, p 199-212, February 1968. 10 fig, 1 tab, 31 ref.

Descriptors: *Water treatment, *Oxidation, *Hydrolysis, *Flocculation, *Iron, Filtration, Lime, Hydrogen ion concentration.
Identifiers: *Activated silica, *Coagulant aid.

Dissolved monomeric silica has marked effects upon rates of oxidation of ferrous iron and on the hydrolysis of ferric iron. It acts to catalyze the oxidation reaction, while it retards the hydrolysis. The interactions suggest several possible consequences; Complexes formed between silica and iron may alter solubility relationships, allowing greater total iron concentrations than otherwise possible; The enhanced rate of oxidation may allow more rapid and complete deferrization of iron-bearing waters, and may explain differences between field observations and laboratory studies; In recognition of the role of chemical interaction in coagulation processes, the effects of silicic acid on iron hydrolysis may eventually help to explain the mechanisms by which polymeric-activated silica functions as a coagulant aid. (Bean-AWWA)
W72-04006

POLIOVIRUS INACTIVATION IN WATER-SOFTENING PRECIPITATION PROCESSES,
Maine Univ., Orono. Dept. of Civil Engineering.
D. F. Wentworth, R. T. Thorup, and O. J. Sproul.
Journal of the American Water Works Association, Vol 60, No 8, p 939-946, August 1968. 6 tab, 11 ref.

Descriptors: *Water treatment, *Water softening, *Viruses, *Bacteriophage, *Hardness (Water), Calcium, Magnesium, Sodium, Hydrogen ion concentration.
Identifiers: *Poliovirus.

Significant poliovirus removal was obtained during the precipitation of calcium and magnesium hardness. Excess lime-soda softening of combined Mg and Ca hardness resulted in the highest inactivation, running up to 99.983 percent. Poliovirus was inactivated during the precipitation of Mg (OH)2 by NaOH; removal was related to the amount of Mg hardness precipitated, Straight lime softening was effective in poliovirus removal to about 70 percent when bicarbonate hardness level was 330 ppm, the removal being in direct proportion to the CaCO3 precipitated in the range of 200-400 ppm hardness. Preformed CaCO3, in the absence of a counter ion, removed little or no poliovirus. Preliminary investigations indicate, over a 90-min period, pH was not a significant factor in the inactivation of poliovirus for the water softening processes investigated. The poliovirus removals correlate well with the T2 bacteriophage removals which have been obtained by other investigators for water softening. (Bean-AWWA)
W72-04007

FILTRATION OPTIMIZATION UTILIZING POLYPHOSPHATES,
Tufts Univ., Medford, Mass.
C. V. Smith, Jr. and S. J. Medlar.
Journal of the American Water Works Association, Vol 60, No 8, p 921-938, August 1968. 7 fig, 3 tab, 25 ref.

Descriptors: *Water treatment, *Water quality, *Filtration, *Head loss, *Coagulation, Turbidity, Iron compounds, Phosphates.
Identifiers: *Filter aid, Jar tests.

Head loss through a filter increases at a lower rate as more hexametaphosphate is applied. At the same time iron coagulant penetrates deeper into the bed. At high phosphate dosage the filter removes turbidity but not iron. Sodium hexametaphosphate can be used as a filter aid to give longer filter runs with no reduction in filtrate quality. Laboratory studies are necessary to determine the limit of tolerance for a particular water quality and coagulant concentration. Trend of iron removal in jar tests paralleled that in filters but the magnitude was significantly different. Turbidity removal trends did not show correlation. Optimum iron removal by the filters and in the jars occurred at the same phosphate concentration. (Bean-AWWA)
W72-04008

REMOVAL OF TRACE METALS BY FOAM SEPARATION PROCESSES,
Ohio State Univ., Columbus. Water Resources Center.
A. J. Rubin.
Journal of the American Water Works Association, Vol 60, No 7, p 832-46, July 1968. 11 fig, 1 tab, 72 ref.

Descriptors: *Water treatment, *Metals, *Foam separation, Iron, Copper, Hydrogen ion concentration, Trace elements, Heavy metals.
Identifiers: Gas flow, Lead.

Use of foam separation processes for the removal of iron, copper and lead from water is discussed. Foam separations may be used to remove aqueous metals and other non-surface-active colligends by several mechanisms. Whether the removal process is a foam fractionization, precipitate flotation, or ion flotation depends primarily on the nature of the metal-collector product, the sublate. Factors affecting the solubility of the sublate, and hence the mechanism, include the coordination behavior of the metal toward the collector surfactant, the nature of the collector, and the pH of the solution. Valuable insights into the mechanism of metal removal by foam separation processes can be obtained by an understanding of the hydrolytic reactions of the metal. Other variables that may significantly affect the removal process include the rate of gas flow, the concentrations of metal and collector, and the ionic strength of the solution. (Bean-AWWA)
W72-04009

CHLORINATION AND DECHLORINATION: A SCIENTIFIC AND PRACTICAL APPROACH,
Wallace and Tiernan Inc., San Francisco, Calif.
G. C. White.
Journal of the American Water Works Association, Vol 60, No 5, p 540-561, May 1968. 10 fig, 24 ref.

Descriptors: *Water treatment, *Chlorination, *Disinfection, *Viruses, Ammonia, Nitrogen compounds, Sulfur compounds.
Identifiers: *De-chlorination.

All waters should be chlorinated to some specific free available chlorine residual. Surface waters should be chlorinated to free residual approximating 85 percent of the total residual. Preferably all chlorine should be applied to water entering the plant, providing contact time through the plant for maximum sterilization with particular reference to virus. Residual leaving the plant should be controlled by application of sulfur dioxide. Residuals should be measured amperiometrically and recorded continuously. Dechlorination by application of ammonia, in dosages equal approximately one-seventh of the chlorine residual present, is discussed extensively. This type of dechlorination is not recommended as the final control, because the reaction time is too long, and it is not possible to control accurately the combined chlorine residual to the proper point on the breakpoint curve. (Bean-AWWA)
W72-04010

NEMATODE REMOVAL BY RAPID SAND FILTRATION,
Chandrawal Water Works II, Delhi (India).
A. K. Seth, M. G. George, J. K. Bewtra, and V. P. Sharma.
Journal of the American Water Works Association, Vol 60, No 8, p 962-968, August 1968. 4 fig 2 tab, 8 ref.

Descriptors: *Water treatment, *Filtration, *Nematodes, *Soil bacteria, *Sand filters, Flow rates.
Identifiers: *Filter loading rates.

Correlations were studied between concentrations of nematodes in filter influent and effluent while using different sizes of filter media at different loading rates. A pilot plant designed to treat 400,000 gpd was used. The raw water was taken from the influent to the Delhi water works. Sands of effective size 0.45, 0.55, 0.65 and 0.75 and uniformity coefficient of 1.35 were utilized, with alum as coagulant. Removal of nematodes by rapid sand filtration is independent of the effective size of the filter media between 0.45 and 0.75 mm. Variation in the loading rate between 7.4 and 9.8 cm/min has very little effect on the efficiency of filters in removing nematodes. About 55-60 percent of the mobile nematodes will pass through the filters operated as conventional rapid sand filters. Nematodes in soil can be activated for such experiments. (Bean-AWWA)
W72-04011

FLOC VOLUME CONCENTRATION,
Camp, Dresser, McKee, Boston, Mass.
T. R. Camp.
Journal of the American Water Works Association, Vol 60, No 6, p 656-673, June 1968. 15 fig, 7 ref.

Descriptors: *Water treatment, *Coagulation, *Flocculation, *Iron compounds, *Mixing, *Filtration, Hydrogen ion concentration.
Identifiers: *Ferric sulfate, Coagulant aids, *Velocity gradient.

Floc volume concentration affects the performance and economy of rapid filters markedly. The most important constituent of hydrous ferric and aluminum oxide floc is water - it may occupy 85 to 99 percent of the volume. The floc volume concentration and size distribution is determined during flocculation by the mean velocity gradient and time. After flocculation is complete at a particular velocity gradient, continued mixing at the same velocity gradient results in little change in floc volume or size distribution. Rapid mixing at sufficiently high velocity gradients in the initial mixing can delay formation of visible floc at low velocity gradients in the flocculation basins for any selected period. Rapid mixing at sufficiently high velocity gradients will disperse floc already formed to particles collodial in size. Ferric oxide crystals were not sheared apart when the floc was dispersed at high velocity gradients. The forces holding the floc particles must be interfacial tension. Since all experiments were made on one tap water, with ferric sulfate dosage of 15 ppm at pH of 6.0, much remains to be done to examine other coagulants and conditions, and the role of coagulant aids vs floc size and volume. (Bean-AWWA)
W72-04012

HIGH-RATE SEDIMENTATION IN WATER TREATMENT WORKS,
Neptune Microfloc, Inc., Corvallis, Oreg.
G. Culp, S. Hansen, and G. Richardson.
Journal of the American Water Works Association, Vol 60, No 6, p 681-698, June 1968. 20 fig, 3 tab, 6 ref.

Descriptors: *Water treatment, *Sedimentation, *Flow rates, *Filtration, Economics, Sludge, Water purification, Sludge, Cleaning, Tubes.
Identifiers: *Mixed-media filters.

Shallow tubes, either nearly horizontal or steeply inclined, are efficient sedimentation devices. Sludge is removed from the essentially horizontal tubes by automatically draining them each time the filter backwashes and refilling them with backwash water. Flow distribution analyses show the shallow horizontal tubes enable good flow distribution to be readily achieved. The continuous self-cleaning of sludge from tubes inclined at a steep angle allows sludge removal to be achieved without the need for draining the tubes. Pilot plant tests show the steeply inclined (60 deg) tubes remove alum floc efficiently at rates as high as 8.5 gpm/sq ft. This led to development of tube modules which were installed in an existing clarifier to increase its capacity from 1.5 to 3.0 mgd. Good clarification was found at rates of 6.6 gpm/sq ft. Installation of tube modules in an existing clarifier and conversion of the filters to mixed-media beds provides plant expansion with substantial savings in cost and space. (Bean-AWWA)
W72-04013

EFFECT OF IONIC ENVIRONMENT AND TEMPERATURE ON THE COAGULATION OF COLOR-CAUSING ORGANIC COMPOUNDS WITH FERRIC SULFATE,
Tennessee Corp., College Park, Ga.
J. S. Maulding, and R. H. Harris.
Journal of the American Water Works Association, Vol 60, No 4, p 460-476, April 1968. 19 fig, 1 tab, 12 ref.

Descriptors: *Water treatment, *Color, *Organic matter, *Coagulation, Iron compounds, Temperature, Metals, Hydrogen ion concentration, Calcium, Magnesium, Sodium, Chlorides, Sulfates.

Optimum conditions for treating colored waters are affected by the type and concentration of ionic species present in the water. The presence of Na+, Ca++, and Mg++ in concentrations to 10 me/l increases the effectiveness of color removal with ferric sulfate and extends the range of good coagulation upwards. The order of effectiveness is Mg++, Ca++, Na+. The presence of Cl- in concentrations to 10 me/l seems to have no effect on coagulation conditions. The presence of SO4= has a deleterious effect on color removal. This effect may be offset by the presence of Ca++ or Mg++ or by the addition of excess ferric sulfate. A soft, alkaline water may require more ferric sulfate than predicted from the color value of the raw water to offset the deleterious effect of SO4= added for acidification. The optimum pH for color removal depends on the coagulation temperature as well as the raw water color. (Bean-AWWA)
W72-04014

HIGH ENERGY FLOCCULATION AND AIR--AND-WATER BACKWASHING,
Walker Process Equipment Corp., Aurora, Ill.
J. D. Walker.
Journal of the American Water Works Association, Vol 60, No 3, p 321-330, March 1968. 3 figs, 2 tab, 7 ref.

Descriptors: *Water treatment, *Mixing, *Flocculation, Coagulation, Filtration, Flow rates, *Filters, Energy gradients, Cleaning.
Identifiers: *Dual-media filters, *Air-water backwash, *Velocity gradient.

Pretreatment now has an important part in preparation of waters for filtration. Camp has demonstrated the value of high energy flocculation which makes the floc formed perhaps 10 times denser. Also, that longer flocculation periods do not necessarily make up for the lack of velocity gradient in the mixing. Studies have confirmed Camp's conclusions. Higher mixing velocities are needed at least in the early part of mixing. A better tool is available for backwashing filters in the form of air-water backwash, which does a better job of cleaning the filter media and saves considerable backwash water. This air-water filter bottom is designed to operate without graded gravel layers thereby saving expense and trouble. Air-water backwash is particularly well adapted to accommodate dual media filters which seem to have a lot of advantages and deserve greater attention. (Bean-AWWA)
W72-04015

COMPARISON OF NORMAL AND REVERSE--GRADED FILTRATION,
Union Carbide Corp., South Charleston, W. Va.
R. W. Oeben, H. P. Haines, and K. J. Ives.
Journal of the American Water Works Association, Vol 60, No 4, p 429-439, April 1968. 8 fig, 1 tab, 10 ref.

Descriptors: *Water treatment, *Filters, *Filtration, *Head loss, Sands.
Identifiers: *Reverse-graded filters.

In spite of the growing literature asserting that reversal of media grading is desirable, no one has demonstrated that this change alone brings any significant improvement in the operation of filters. Studies comparing 24-in. sand beds show that (a) with an inverted filter a more linear head loss is obtained, indicating that the floc is deposited more evenly throughout the sand bed, (b) filter runs with 50 percent of the normal head loss are obtained with the inserted beds, with no deterioration of filtrate quality, (c) finer sands remove floc mor efficiently than do coarser sands, therefore the upper layers of normal filters dominate the action of the bed, (d) the favorable findings of this study, when coupled with those from prior studies indicate that considerable effort is warranted toward development of a practical reverse-graded filter that does not suffer from the limitations of normal backwashing procedures. (Bean-AWWA)
W72-04016

USE OF PILOT FILTERS TO PREDICT OPTIMUM CHEMICAL FEEDS,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
J. F. Kreissl, G. G. Robeck, and G. A. Sommerville.
Journal of the American Water Works Association, Vol 60, No 3, p 299-314, March 1968. 14 fig, 9 tab, 11 ref.

Descriptors: *Water treatment, *Coagulation, *Filtration, *Flow rates.
Identifiers: Pilot filters, Dual-media filters.

Use of small pilot filters to determine the correct chemical dosages for a water treatment plant was evaluated. Clean pilot filters operated at high rates are capable of simulating hydraulic conditions of an identical, clogged filter operated at normal rates of filtration. Minimum coagulant dosages can be found by use of pilot filters at normal rates in much the same way as the jar test. The floc-strength of any chemical dosage, whether coagulant alone or with filter aid, can be assessed by pilot filters operated at equivalent filtration rates which have the same pore velocities as the clogged filter. The optimum chemical dosage can be found by use of pilot filters for systems that exclude flocculation and sedimentation. Filters operating at 2 gpm/sq ft remain in laminar flow throughout the duration of a run to 7-ft total head loss. Geometric shape factors of clean filters remain relatively constant throughout a filter run. Neither sand nor coal single-media filters are practical for the treatment system used in this study. (Bean-AWWA)
W72-04017

REMOVAL OF POLIOVIRUS 1 FROM SECONDARY EFFLUENTS BY LIME FLOCCULATION AND RAPID SAND FILTRATION,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
G. Berg, B. D. Dean, and D. R. Dahling.
Journal of the American Water Works Association, Vol 60, No 2, p 193-198, February 1968. 1 fig, 5 tab, 4 ref.

Descriptors: *Water treatment, *Viruses, *Flocculation, *Filtration, Lime, Hydrogen ion concentration, *Decontamination.
Identifiers: *Poliovirus.

Effectiveness of flocculation with lime, followed by settling and rapid sand filtration for the removal of viruses from secondary effluents was determined. Poliovirus 1 innoculated into secondary effluent was not rapidly adsorbed or inactivated and could be recovered readily. Flocculation of secondary effluent with 200-500 ppm of lime removed less than 70-99.86 percent of the poliovirus 1. The amount of removal depended upon the concentration of lime and the pH level attained. Filtration through 8 in. of sand removed from 82-99.8 percent of the virus. Total removal of virus by lime flocculation and sand filtration ranged from 98.6 to greater than 99.997 percent. (Bean-AWWA)
W72-04018

STOICHIOMETRY OF COAGULATION,
Harvard Univ., Cambridge, Mass.
W. Stumm, and C. R. O'Melia.
Journal of the American Water Works Association, Vol 60, No 5, p 514-539, May 1968. 10 fig, 3 tab, 50 ref.

Descriptors: *Water treatment, *Coagulation, *Flocculation, *Sedimentation, Hydrolysis, Adsorption, Electrolytes, Mixing, Hydrogen ion concentration.
Identifiers: *Filterability, Polyelectrolytes, Velocity gradient.

Reaction steps in coagulation are: hydrolysis; adsorption of hydrolysis species to accomplish destabilization of the colloids, aggregation of destabilized particles by bridging, aggregation by particle transport and Van der Waals forces, aging, and precipitation of the metal hydroxides. Some steps occur sequentially, some overlap and some occur concurrently. By careful choice of coagulant dosage, pH and perhaps coagulant aids, the rates of pertinent chemical reactions may be adjusted so that particle transport controls the overall rate of aggregation. In many natural systems particle transport is achieved by orthokinetic flocculation and therefore is influenced by the velocity gradient. More attention should be directed to the physical and chemical properties of flocs, density, shear strength, compressibility, filtrability. Trace quantities of impurities can have dramatic effects on the physical and chemical properties of the resulting flocs. Recent development of synthetic polyelectrolytes suggests many potentially beneficial effects on both the kinetics of floc formation and on the properties of the floc. (Bean-AWWA)
W72-04019

CHEMICAL ASPECTS OF COAGULATION,
Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
W. Stumm, and J. J. Morgan.
Journal of the American Water Works Association, Vol 54, No 8, p 971-994, August 1962. 12 fig, 1 tab, 50 ref.

Descriptors: *Water treatment, *Coagulation, *Color, *Proteins, *Colloids, *Hydrolysis, Hydrogen ion concentration, Iron compounds, Aluminum.

A comprehensive theory of coagulation phenomena should explain coagulation effectiveness in terms of pH, buffer capacity, hydrolysis equilibria of the coagulant metal ions, complex formation equilibria, and the chemical equilibria of the colloidal or dissolved substances to be removed. Coagulant metal ions are hydrolyzed in aqueous solution. Considerable evidence exists to support the view that iron and aluminum hydrox-

ide precipitates are polynuclear complexes. Research indicates that the hydrolysis product of aluminum ion in pH range 4 to 7 is a tripositive or tetrapositive polynuclear species. Iron hydrolysis products constitute a distribution of various species, the charge and structure of which are governed by pH. Complex formation reactions between aluminum or iron coagulant metal ions and carboxylic, phosphato, sulfato, or aromatic hydroxyl functional groups are important in the destabilization of such naturally occurring colloidal or dissolved impurities as color, proteins and carbohydrates. Phosphates, salicylates and oxalates form both soluble complexes and insoluble precipitates with aluminum. (Bean-AWWA)
W72-04072

WATER SUPPLY AND TREATMENT IN THREE EUROPEAN COUNTRIES,
North Carolina Univ., Chapel Hill. School of Public Health.
For primary bibliographic entry see Field 04B.
W72-04075

LIME ACID REACTION FOR WATER STABILIZATION,
Aqua-Aid Ltd., Johannesburg (South Africa).
S. P. Lawson, and R. Snyders.
Journal of the American Water Works Association, Vol 54, No 2, p 176-180, February 1962. 3 fig, 3 tab, 6 ref.

Descriptors: *Water treatment, *Saturation, *Lime, *Acids, *Hydrogen ion concentration, Water quality, Treatment facilities.
Identifiers: South Africa, *Stabilization.

A process is described for stabilizing South African mountain spring waters, which contain less than 20 ppm dissolved solids and 3 ppm total hardness. The process involves application of a cheap acid such as sulfuric, ground limestone, and finally hydrated lime for pH adjustment. All of the water can be treated or part of it treated and then blended. Plant and equipment are simple and costs are much lower than those with other treatments. Treatment with 240 lb (Imp.) of Lime flour, 170 lb/mil gal of H2SO4 and 72 lb/mil gal ca (OH)2 adjusts the water characteristics approximately as follows: pH 5.9 to 9.2; M.O. alkalinity 2.8 to 16.8; total hardness 2.8 to 29.9; pH of saturation 10.6 to 9.0; saturation index minus 4.7 to plus 0.2. (Bean-AWWA)
W72-04082

ECONOMICS OF WATER SOFTENING,
Alvord, Burdick and Howson, Chicago, Ill.
L. R. Howson.
Journal of the American Water Works Association, Vol 54, No 2, p 161-166, Feb 1962. 5 fig, 3 ref.

Descriptors: *Water treatment, *Economics, *Hardness (Water), *Ion exchange, *Water softening, Water quality, Municipal water, Wisconsin.

The growth in municipal water softening is traced, also the growth in use of home softeners or rental softening. Costs, benefits and some difficulties involved in both types of softening, are described. In four major Wisconsin cities, consumers spend more to individually soften about 20 per cent of the water than the cities collect for developing, purifying and delivering all of the water. These cities could soften their entire supplies at a cost considerably lower than that now spent to soften a small percentage. Municipal softening of hard water is economical and in the consumer's interest and it should be part of a good water supply service. Generally, where the hardness of the public water supply exceeds 250 ppm, more than 50 percent of the consumers have individual softeners. (Bean-AWWA)
W72-04096

AUTOMATIC VALVELESS GRAVITY FILTERS,
Permutit Co., Silver Spring, Md.
D. M. McKee.
Journal of the American Water Works Association, Vol 54, No 5, p 603-605, May 1962. 2 fig.

Descriptors: *Water treatment, *Filters, *Flow control, *Instrumentation, Head loss, Treatment facilities.

The automatic valveless gravity filter operates without butterfly valves, pilot mechanisms, rate controllers, gages, graphic panels, or air compressors. No loss-of-head indicator, backwashing controller, or pump is required. The filter has two sections-the filtering cell and the wash water compartment. As incoming water is admitted to the filter, head builds up on top of the sand and causes the water level to rise in the backwash pipe. The syphonation is started and washing begins. Wash water flows from the storage tank up through the sand bed and is discharged through the backwash pipe. A syphon breaker ends the wash cycle. The filter reverses itself and filtering downflow proceeds to fill the storage tank. When the tank is filled, filter water then passes on to service. The unit washes itself at the proper time at a given head loss, without benefit of instrumentation. This eliminates wasting of water by washing to soon and eliminates overrunning, with resultant buildup of negative heads and possibility of an improperly cleaned sand bed. The filters have been in commercial use for more than 5 years. More than 60 installations, nearly all multiple-unit, have been made. (Bean-AWWA)
W72-04102

5G. Water Quality Control

ECONOMIC AND ORGANIZATIONAL ISSUES IN ALASKA WATER QUALITY MANAGEMENT,
Alaska Univ., Fairbanks. Inst. of Water Resources. Alaska Univ., Fairbanks. Inst. of Social, Economic and Government Research.
G. K. Erickson, and A. R. Tussing.
Available from the National Technical Information Service as PB206 185, in paper copy, $0.95 in microfiche. Publication No. IWR-16 and ISEGR Occasional Paper No. 5, Sept 1971, 20 p, 2 fig, 23 ref. OWRR A-029-ALAS (1).

Descriptors: *Water management, *Economic impact, *Institutions, Administrative agencies, *Alaska, *Oil wastes, Water quality control.
Identifiers: *Prince William Sound (Alas), Cook Inlet (Alas), *Episodic pollution, *Oil pollution.

The open literature and state statutes are used to develop a generalized conceptual framework for water quality management and control based solely upon economic considerations. Major emphasis was placed upon episodic pollution rather than chronic cases. The discussion then treats the Alaska situation in particular, with oil pollution stressed in the Prince William Sound area (near Valdez, the terminus of the proposed Trans Alaska Pipeline). The administrative structure of the State of Alaska, as pertains to water management, is discussed. (Murphy-Alaska)
W72-03260

WATER QUALITY STANDARDS AND POLLUTION ABATEMENT EFFORTS OF NEW YORK AND VERMONT.
Federal Water Pollution Control Administration, Washington, D.C.

In: Conference on Pollution of Interstate Waters of Lake Champlain and Its Tributary Basin - New York - Vermont, p 89-95, 195-229, 271-287, 289-378 (1969).

Descriptors: *Water pollution control, *Water pollution treatment, *Pollution abatement, *Standards, Pollutant identification Statistics, Regulation, Permits, Coordination, Sampling, Administrative agencies, Water quality control, Dredging, Sewage treatment, Lake basins, Lake beds, Water pollution sources, Lakes, New York, Vermont, Water pollution effects, Legal aspects.

Detailed reports were presented on the water quality standards of New York and Vermont. Both states classify water in categories such as A,B,C, in descending order of water quality allowable. Some conflict appeared as to specific criteria for some classifications, and recommendations were made thereto. Each classification contains specific criteria for allowable amounts of solid waste, bacteria, turbidity, and temperature deviation, among others. Both states are pursuing efforts to abate pollution, and recommendations were made respecting coordination of these efforts. The New York representative reported on actions taken against municipal and industrial polluters. The major single pollution source discussed, the Ticonderoga paper mill, was reported to be relocating its plant, and the company representative outlined treatment facilities at the new plant to insure that pollution did not occur. State, interstate, and construction grant programs were discussed. (Caldwell-Florida)
W72-03517

LAKE BASIN CHARACTERISTICS AND NATURE AND EXTENT OF THE POLLUTION PROBLEM.
Federal Water Pollution Control Administration, Washington, D.C.

In: Conference on Pollution of Interstate Waters of Lake Champlain and Its Tributary Basin - New York - Vermont, p30-88, 99-111, 119-194, 230-270, 379-408 (1969).

Descriptors: *Lake basins, *Water pollution sources, *Water pollution effects, *Impaired water quality, Water pollution control, Eutrophication, Biochemical oxygen demand, Lake beds, Lake soils, Pollutant identification, Industrial wastes, Thermal pollution, Epilimnion, Thermocline, Hypolimnion, Lake fisheries, Bacteria, Lake morphology, Pulp wastes, Sludge, Odor, Turbidity, Recreation, Statistics, Pollution (Thermal).
Identifiers: *Lake ecology.

Lake Champlain is a long, narrow lake running north-south and forming a portion of the boundary between New York and Vermont. At the Conference the major area of pollution was said to be toward the southern end of the lake and centered around a large paper mill at Ticonderoga. Detailed statistical evidence of the sources and effects of pollution was presented, along with charts showing lake profiles as to turbidity, oxygen drawdown and other effects. The buildup of sludge deposits from the mill, bacterial hazards, the presence of floating wastes, unpleasant odors, and thermal pollution were discussed as major problems. The effects of this pollution were reported to be unsuitability of the water for recreation, with consequent decline in the economics of surrounding communities, disastrous effect on lake fisheries, upsetting lake ecology, adverse aesthetic effect, eutrophication, and the possible adverse effects of thermal pollution on lake stratification. The adverse effects of industrial and municipal pollution on a valuable natural resource were thus, shown graphically by statistical and testimonial evidence. (Caldwell-Florida)
W72-03518

CONFERENCE PURPOSE, AUTHORITY, AND RECOMMENDATIONS.
Federal Water Pollution Control Administration, Washington, D.C.

In: Conference on Pollution of Interstate Waters of Lake Champlin and Its Tributary Basin New York - Vermont p 15-29, 409-416, 47-48, 161-62 (1969).

Descriptors: *Conferences, *Water pollution control, *Governments, *Lakes, Pollution abatement, Programs, Coordination, Water pollution treatment, Lake basins, Impaired water quality, Treatment facilities, Legislation, Administrative agencies, Industrial wastes, Water pollution sources, Regulation, Biochemical oxygen demand, Dissolved oxygen.
Identifiers: *Federal Water Pollution Control Act, Water quality criteria.

The Conference was convened pursuant to paragraph 10 of the Federal Water Pollution Control Act in order to give representatives of state and federal agencies a chance to effect efficacious pollution abatement procedures regarding Lake Champlain. The Conference was to hear and consider evidence as to the nature of the pollution and methods of control, and make findings of fact and recommendations as to abatement. Specific recommendations included upgrading of New York's classifications of water quality criteria and insuring adequate treatment of waste discharged into the Lake. Specific criteria for removal of biochemical oxygen demand, adequate disinfection, and insuring the proper amount of dissolved oxygen were made. Studies dealing with removal of sludge deposits and establishment of water quality requirements at the state line, including dissolved oxygen, temperature and bacteria, were recommended. (Caldwell-Florida)
W72-03519

STREAM FAUNAL RECOVERY AFTER MANGANESE STRIP MINE RECLAMATION,
Virginia State Cooperative Fishery Unit, Blacksburg.
For primary bibliographic entry see Field 05C.
W72-03530

EXPERIMENTAL AND THEORETICAL STUDY OF THE HYDRODYNAMICS OF DISPERSION IN RIVERS AND ESTUARIES,
Hydronautics, Inc., Laurel, Md.
For primary bibliographic entry see Field 05B.
W72-03540

MANAGEMENT PROBLEMS IN METROPOLITAN WATER RESOURCE OPERATIONS,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 06B.
W72-03553

BACTERIAL QUALITY OF IRRIGATION CANAL WATERS IN THE AGRICULTURAL-URBAN COMPLEX OF THE SALT RIVER VALLEY, ARIZONA,
Arizona State Univ., Tempe.
John W. Klock.
College of Engineering, Arizona State University, Engineering Research Center Publication. 34 p, 11 fig, 10 tab.

Descriptors: *Water quality control, *Urbanization, Water resources development, *Irrigation, *Return flow, Storm run-off, Sampling, Monitoring, Microorganisms, Laboratory tests, *Arizona, Water pollution control.
Identifiers: Most probable number, *Salt River Valley (Ariz).

The Salt River Project derives surface waters from a 13,000 sq. miles drainage basin and delivers it through a series of six dams on the Salt and Verde Rivers to the SRP Service Area of 250,000 acres. Recent population growth has transformed the Salt River Valley from a basically agricultural community with scattered small towns to a series of large urban centers. 30 water sampling locations were used to obtain samples of water for analysis to determine what recent changes in water quality have occurred. Attempts were then made to correlate the microbial concentrations existing at various points along the arterial canals with associated physical factors believed to be of significance. Tests showed that water from the SRP watershed at the Verde Water Treatment Plant was essentially unchanged in 18 years as measured by coliform group analyses. Water reaching the Squaw Creek Treatment Plant via the Arizona Canal was of degraded quality, seemingly due to increased recreational uses and urbanization. Agricultural return flow and street run-off appear to be significant factors in increased levels of coliforms and fecal streptococci organisms. (Lowry-Texas)
W72-03612

THE ENGINEER'S RESPONSIBILITY IN ENVIRONMENTAL POLLUTION CONTROL.
National Industrial Pollution Control Council, Washington, D.C.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Price $0.25. Report COM-71-50069, March 1971. 18 p.

Descriptors: *Technology, *Professional personnel, Waste disposal, Solid wastes, Air pollution, Water pollution control, Technical societies, Engineering education.
Identifiers: *Environmental degradation.

Technological advances, which have helped to bring about the highest standard of living the world has ever known, have also produced much degradation of the world's natural environment. Recent public outcry has directed the force of technology towards cleaning up the mess created in the last 50 years. At the same time, engineers are becoming more responsive to environmental questions regarding new development and innovations. This report recommends that the engineer, in addition to his traditional role, should: (1) provide technical leadership in detecting and defining environmental problems and in solving them imaginatively and effectively, employing a realistic evaluation of the costs involved; (2) develop improved communications, empathy, understanding and knowledge in working with the social and political sciences towards common objectives, and encourage indisciplinary approaches to environmental problems, helping to organize, coordinate, and implement such programs when needed; (3) encourage a better rapport with the public at large; (4) develop closer working relationships with educational institutions and professional societies, encouraging liberalization of the engineering curricula, and furtherance of the exposure of practicing engineers to socio-political concepts as they relate to environmental problems through professional societies; (5) recognize the importance of national commitment to environmental pollution control, not only for a higher living standard but a better quality of life as well. (Lowry-Texas)
W72-03618

PRELIMINARY STEPS IN WASTE TREATMENT,
MacDermid, Inc., Waterbury, Conn.
For primary bibliographic entry see Field 05D.
W72-03625

A REPORT ON THE CONTROL OF CHROMIUM IN PLATING SHOP EFFLUENTS.
American Electroplaters Society, Newark, N.J. Environmental Pollution Control Subcommittee.
For primary bibliographic entry see Field 05D.
W72-03628

USE OF ACTIVATED CARBON TO PREVENT WATER SUPPLY CONTAMINATION,
West Virginia Pulp and Paper Company, Covington, Va. Carbon Technical Service Lab.
A. Y. Hyndshaw.
Water and Wastes Engineering, Vol 6, No 2, February 1969, p 42-44.

Descriptors: *Activated carbon, *Adsorption, *Water treatment, *Waste water treatment, Algae, Filtration, New Hampshire, New York, Virginia, Organic compounds, Lagoon, Filters, Pesticides, Sludge, Digestion, Indiana.
Identifiers: *Carbon filters, Lebanon, Batavia, Clarksburg, Buffalo, Dunreith, Oil spills.

Most organics that might be potential contaminants of potable water supplies can be effectively removed or inactivated by application of activated carbon. In 1929, after phenol-contaminated water caused spoilage of some meat at a Chicago meat packing company, it was found that powdered carbon could be used to prevent this type of contamination. Since that time, use of activated carbon has expanded greatly. Today most water treatment plants use activated carbon to remove taste and odor-causing substances that are not removed by such processes as coagulation, flocculation, and filtration. Applications of carbon to impounded supplies will also control algae growths. Powdered carbon has been used very effectively to correct conditions resulting from oil spills. The very great surface areas attract and hold large quantities of oil. After a fire in a warehouse released large amounts of ethylene glycol into a river in Clarksburg, Virginia, activated carbon was fed at a rate of 10 mg/l until the contamination passed. This amount was sufficient to eliminate tastes and odors. In Buffalo, an industry used 55 gallon barrels with carbon as makeshift filters to eliminate tricresyl phosphate from water before discharging it into a stream. Carbon treatment has also been used to adsorb DDT and similar pesticides. Addition of powdered carbon at the grit chamber in water treatment plants has been shown to reduce atmospheric odors, accelerate settling, improve digestion, and reduce foam formation. (Biggs-Texas)
W72-03641

HIGH SCORE IN AIR/WATER QUALITY SET BY AMERICAN CAN KRAFT MILL.

Paper Trade Journal, Vol 154, No 11, March 16, 1970, p 46-53. 12 fig.

Descriptors: *Water pollution abatement, *Air pollution, *Odor, Design, Water reuse, Waste water treatment, Aeration, Chlorination, Costs, *Pulp wastes, Industrial wastes.
Identifiers: Electrostatic precipitators, Cyclones, Venturi scrubbers, Chemical recovery, Clarification.

American Can's $40 million plant for the manufacture of kraft pulp, paper and tissue products is an outstanding example of the use of advanced techniques for the control of air and water pollution. Approximately $4 million of the plant's cost is directly attributable to air and water quality systems. Processes were selected for incorporation in the extensively automated plant that minimized odor production and which facilitated the use of recycled water. Exhaust gases and dusts are collected and burned to prevent escape into the atmosphere. Chemical and fiber losses are minimized and there are safeguards for accidental spills. A dry bottom electrostatic precipitator, venturi scrubbers and cyclones used in various sections of the plant to insure maximum recovery of useful chemicals and minimum contamination of the air. The plant operates its own wastewater treatment system consisting of a Dorr-Oliver primary clarifer, two 60 acre aeration ponds, a 2.5 million gal. secondary clarifier and chlorination basin. The effluent is discharged into the local river through a sparger to insure even distribution across the river. The American Can Company's kraft and paper mill at Halsey, Oregon is a fine example of the efficiency and pollution abatement that can be incorporated into a modern paper plant. (Goessling-Texas)
W72-03648

BETA-OXIDATION OF FATTY ACIDS BY LEPTOSPIRA,
Massachusetts Univ., Amherst. Dept. of Microbiology.
For primary bibliographic entry see Field 05C.
W72-03729

WATER POLLUTION FROM OIL SPILLS CAN BE PREVENTED.

Public Works, Vol. 101, No. 11, November 1970, p 53.

Descriptors: *Water pollution control, Oil industry, Transportation, Winds, Currents (Water), Pumps, *Oil wastes.
Identifiers: *Floating booms, Skimmer head, *Oil spill recovery.

Oil is one of the worst polluters of the world's waters. Proper planning, good crew training and the immediate use of the proper equipment can drastically reduce the possibility of pollution. Research and development engineers have discovered some rather remarkable facts about the interaction of oil, water and wind. Wind direction, for example, is more important than water currents as a factor in controlling spills. Oil is lighter than water and is more likely to be affected by, and moved in the direction of the wind, even if the direction is opposite that of the water current. A floating oil boom will control spills of most grades of oil in any quiet water, and in some situations on the high seas. Slickbar, Inc. manufacturers oil booms made of polyethylene attached to a continuous plastic fin, weighted down with lead ballasts. A recovery device made by the company, Slickskim, is designed to remove the oil once a slick is brought under control. It consists of a synthetic foam rubber head with numerous holes through which oil and water can be pumped. The skimmer head is attached to a floating hose which crosses the boom on a special bridge. The device is said to recover more than 90% of an oil spill at rates up to 250 barrels per hour. (Goessling-Texas)
W72-03749

AN INDUSTRIALIST'S CONCERN FOR THE ENVIRONMENT,
Weyerhauser Co., Yakima, Wash.
Norton Clapp.
Water and Wastes Engineering, Vol. 7, No. 10, October, 1970, p 58-59.

Descriptors: *Environment, *Degradation (Decomposition), Population, Industries, Air pollution, Soil contamination, Water pollution control, Ecology, Economics, Decision making, *Environmental effects.
Identifiers: Automobiles, Affluence.

Degradation of the environment has existed since the beginning of mankind. This problem has achieved prominence in our age due primarily to the increase in population and a general increase in affluence. Our civilization is in a deflationary spiral where environmental quality is concerned. An industry is developed to meet a citizen demand for a product. It hires citizens who move to the vicinity of the plant, increasing population density, and consumer demand. Weyerhauser has been involved in preserving environmental quality and in reducing pollution through good housekeeping and improved pollution abatement devices. However, the fundamental approach to the total problem must involve all of us, citizen, industry and government. There are many basic decisions that must be made that touch all of our lives. Some of these are: (1) the size of families; (2) balance between electric power and environmental dislocation; (3) population density, (4) mass transit; and (5) standard of living versus ecological impact. These problems are difficult to solve but they are capable of solution. Hopefully, we can all work together toward these solutions. Most of the technology is already available, now we need a cooperative and rational approach to develop the balance of the techniques and the mechanisms of application to preserve the highest quality of life. (Goessling-Texas)
W72-03751

GROUNDWATER POLLUTION IN RHODE ISLAND: A STUDY OF LAW AND ADMINISTRATION,
Rhode Island Univ., Kingston. Water Resources Center.
For primary bibliographic entry see Field 06E.
W72-03761

OXYGEN REGENERATION OF POLLUTED RIVERS: THE DELAWARE RIVER,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
William Whipple, Jr., Joseph V. Hunter, Shaw L. Yu, Frank W. Dittman, and George W. Mattingly.
Copy available from GPO Sup Doc as EPA-WQO Program 16080 DUP 12/70, $1.00; microfiche from NTIS as PB-201 649, $0.95. Water Pollution Control Research Series, December 1970. 86 p, 29 fig, 11 tab, 41 ref, append.

Descriptors: *Dissolved oxygen, Water quality control, *Oxygen sag, *Aeration, *Stream improvement, Stream pollution, Biochemical oxygen demand, Dispersion, *Pollution abatement, Water pollution control, *Delaware River.
Identifiers: *Surface aerators, Air diffusers, Induced oxyge ation, *Instream aeration, Philadelphia.

Tests of surface instream aerators and of bottom diffuser aerators were conducted on the Delaware River near Philadelphia in order to determine the practicability of induced oxygenation of deep navigable rivers. The diffuser was tested at various depths up to 38 feet, but its performance in pounds of oxygen per horsepower hour decreased markedly in the deeper water. Performance of the surface aerator appeared to be somewhat improved over results previously found in a shallower river. Cost estimates and systems analysis led to the conclusion that induced oxygenation by aerators appears to constitute an economical alternative to advanced waste treatment on the Delaware River. This would require structurally reinforced surface aerators in some areas, and bottom diffuser aerators where the surface aerators would interfere with navigation. However, oxygen diffusers developed by others may provide an even more economical means of induced oxygenation for such rivers. (See also W72-03780)
W72-03779

OXYGEN REGENERATION OF POLLUTED RIVERS: THE PASSAIC RIVER.
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.

Copy available from GPO Sup Doc for $0.65; microfiche from NTIS as PB-206 190, $0.95. Environmental Protection Agency, Water Pollution Control Research Series, March 1971. 56 p, 15 fig, 6 tab, 27 ref. EPA-WQO Program 16080 FYA 03/71.

Descriptors: *Water pollution control, Water quality control, Stream improvement, *Pollution abatement, *Aeration, Mathematical models, Water pollution control, New Jersey.
Identifiers: *Instream aeration, *Induced oxygenation, Surface aerators, Air diffusers, *Passaic River.

Field tests were made of a mechanical surface aerator and of pure oxygen diffusers in a small polluted river, the upper Passaic. Results generally corroborated results of previous test, as to performance of surface aerators on such rivers, in excavated pools. A somewhat higher oxygen transfer rate was obtained with a flow concentration device, which, in a permanent installation, would take the form of low rock spur dikes, one extending from each bank, or flow concentration grains. Tests in shallower water, about 7 feet deep, were inconclusive. Tests of oxygen diffusers were fragmentary, due to mechanical difficulties with the equipment; but it was demonstrated that the very fine bubbles used were very largely absorbed in the water. A dye dispersion test gave a very high longitudinal dispersion coefficient downstream of the aerator. Mathematical modelling indicated that during the period of test, parameters of biochemical deoxygenation were not changed by the artificial aeration process. (Whipple-Rutgers)
W72-03780

MECHANICAL AERATION SYSTEMS FOR RIVERS AND PONDS,
Littleton Research and Engineering Corp., Mass.
William T. Hogan, F. Everett Reed, and Albert W. Starbird.
Copy available from GPO Sup Doc for $1.25; microfiche from NTIS as PB-206 218, $0.95. Environmental Protection Agency, Water Pollution Control Research Series, November 1970. 134 p, 22 fig, 14 tab, 46 ref, 3 append. EPA-WQO Program 16080DOO 7/70.

Descriptors: *Aeration, Rivers, Ponds, *Economic prediction, *Hydraulic engineering, *Air entrainment, Bubbles, Dissolved oxygen, Water circulation, Mixing, *Oxygenation, Water quality control, Costs.
Identifiers: *Mechanical aerators, Aeration efficiency.

The total annual cost of providing supplemental aeration of streams and lakes by tested and untested aeration equipment is estimated. Analytical and empirical equations are presented for the determination of operating characteristic of the various devices used to aerate natural bodies of water. For the example stream evaluated in this study, the most economical means of artificial aeration generally possible was found to be mechanical aerators which generate a highly turbulent white-water surface. For the example lake evaluated, the most economical technique for the continual input of oxygen into a lake was found to be diffused aeration using air bubbles; whereas the most economical technique for rapid input of oxygen, operating only while the lake is being destratified, was found to be a hybrid system consisting of a large diameter ducted propeller which draws water from the lake bottom and discharges it at the surface where it is aerated by a mechanical aerator.
W72-03781

CONTROL OF POLLUTION FROM OUTBOARD ENGINE EXHAUSTS: A RECONNAISSANCE STUDY.
Alaska State Dept. of Fish and Game, Juneau. Sport Fish Div.
For primary bibliographic entry see Field 05B.
W72-03783

CONTROL OF MINE DRAINAGE FROM COAL MINE MINERAL WASTES PHASE I - HYDROLOGY AND RELATED EXPERIMENTS,
Truax-Traer Coal Co., Pinckneyville, Ill.
For primary bibliographic entry see Field 05B.
W72-03785

PETROLEUM POLLUTION ABATEMENT,
Oklahoma Corp. Commission, Oklahoma City.
Sam F. Shakely.
Proc Okla Acad Sci. 50: 155-158. 1970.
Identifiers: Abatement, Commission, Corporation, Disposal, Effluent, Injection, Oklahoma, Petroleum, Pollution, Refinery, Salt, Wells.

The problems existent in Oklahoma, and the steps that have been taken for abatement of pollution are discussed. In 1969 the rules were changed to allow administrative approval of salt water disposal and injection wells, in place of the public

hearings previously required. The regulations and disposal of refinery effluent also comes under the jurisdiction of the Oklahoma Corporation Commission. To assist the refineries in waste control expenditures, a tax credit has been established.--Copyright 1971, Biological Abstracts, Inc.
W72-03801

SUMMARY OF FIELD TRIALS IN 1964-69 IN RANGOON, BURMA, OF ORGANOPHOSPHORUS LARVICIDES AND OILS AGAINST CULEX PIPIENS FATIGANS LARVAE IN POLLUTED WATER,
World Health Organization, Seoul (Korea). Japanese Encephalitis Vector Research Unit.
L. S. Self, and M. M. Tun.
Bull W H O. 43 (6): 841-851. 1970. French summary.

Descriptors: Abate, Burma, Culex-Pipiens-Fatigans, Dursban, Fenthion, Field, Larvae, Larvicides, Oils, Organo, Phosphorus, Polluted, Rangoon, Trials.

Tests of the larvicidal activity of various organophosphorus compounds against C. p. fatigans, showed that the activity usually lasted much longer in septic tanks and pit latrines than in open drains. Dursban, Abate, fenthion and several other emulsifiable concentrates caused high larval mortality at a concentration of 0.05 ppm but 0.5 ppm was normally required to obtain a minimum of 1-2 wk of complete larval control. For the desired residual activity, dosages about 40-400 times the laboratory LC95 values were normally required, depending on the compound used. The most effective formulation was Dursban emulsifiable concentrate, which, at a concentration of 0.5 ppm, was effective for 3,7 and 12 wk in concrete drains, pit latrines and septic tanks, respectively. Petroleum oils applied at rates of 25-40 US gal/ac (approx. 237 l/ha-380 l/ha) and a pyrethrum derivative at a concentration of 1.0 ppm were toxic to larvae but not highly residual. Some emulsifiable-concentrate/oil mixtures appeared to be outstandingly effective, although inconsistent results also occurred. Granular formulations were normally less effective than the emulsifiable concentrates.--Copyright 1971, Biological Abstracts, Inc.
W72-03813

SANITARY-HYGIENIC CHARACTERISTICS OF METHYLPYRROLIDONE AS A WATER POLLUTANT,
Kiev Research Inst. of General Communal Hygiene (USSR).
For primary bibliographic entry see Field 05C.
W72-03815

POLLUTION CONTROL IN STEELMAKING: FACT OR FICTION,
Rand Corp., Santa Monica, Calif.
D. P. Tihansky.
Availabile from NTIS, Springfield, Va 22151 as AD 731 262, $3.00 paper copy, 95 cents microfiche. Rand Corporation Report, January 1971. 6 p, 13 ref.

Descriptors: *Water pollution control, *Industrial wastes, *Steel, *Pollution abatement, Air pollution, Water pollution treatment, Water quality control, Waste water treatment, Costs, Reviews.
Identifiers: *Steel industry.

The progress of one of the largest waste generators - the American steel industry - is examined in its abatement research and consequent air and water quality control programs. Public concern about steelmaking waste discharges is emphasized, and some economic and technical difficulties in meeting abatement standards in steel plants are identified. Aggregate cost data related to the installation, operation, and maintenance of waste control equipment are reviewed, and these expenditures reveal the steel industry's positive response to pollution control regulations. Over the 16 year period starting in 1951, for example, steel corporations in the United States (accounting for 98% of total ingot steel production) committed about $600 million to air and water pollution abatement facilities. Of this amount, roughly 58% was expended for water treatment devices. (Woodard-USGS)
W72-03856

A STATISTICALLY BASED MATHEMATICAL WATER QUALITY MODEL FOR A NON-ESTUARINE RIVER SYSTEM,
Stevens Inst. of Tech., Hoboken, N. J. Dept. of Economics of Engineering and Management Science.
For primary bibliographic entry see Field 05B.
W72-03877

CHEMICAL POLLUTION OF THE COASTAL WATERS OF SEAS OF THE USSR (KHIMICHESKOYE ZAGRYAZNENIYE PRIBREZHNYKH VOD MOREY SSSR),
State Oceanographic Inst., Moscow (USSR).
For primary bibliographic entry see Field 05B.
W72-03902

BEHAVIORAL ASPECTS OF WATER MANAGEMENT: A PARADIGM AND A CASE STUDY,
Waterloo Univ. (Ontario). Div. of Environmental Studies.
For primary bibliographic entry see Field 06B.
W72-03929

IDENTIFICATION OF MANAGEMENT AND PLANNING PROBLEMS OF URBAN WATER RESOURCES IN THE METROPOLITAN AREA OF GREATER SAN ANTONIO,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 06B.
W72-03930

ENVIRONMENTAL PERCEPTIONS AND ATTITUDES OF ENGINEERS AND PUBLIC HEALTH OFFICIALS,
Victoria Univ. (British Columbia).
For primary bibliographic entry see Field 06B.
W72-03931

ENVIRONMENTAL PROGRAMS OF THE FUTURE,
Environmental Protection Agency, Washington, D.C.
D. D. Dominick.
Journal of Soil and Water Conservation, Vol 26, No 5, p 180-182, September-October 1971. 1 photo.

Descriptors: *Environment, *Pollution abatement, *Air pollution, *Water pollution, *Water quality, *Water quality control, *Solid wastes, *Pesticides, *Radiation, Decision making, Administration, Standards, Federal government, State governments, Local governments.
Identifiers: *Environmental Protection Agency (EPA), *Noise pollution, Policy making, 'Whole earth concept'.

A review of the structure, responsibilities, and programs of the Environmental Protection Agency (EPA) is presented. EPA forms one organizational unit which deals with the Federal programs involving air and water pollution, drinking water quality, solid wastes, pesticides, environmental radiation, and noise pollution. It is responsible for establishing standards and enforcing them, monitoring pollution, conducting research and demonstration, and assisting state and local governments in their pollution-control efforts. EPA works closely with two other environmental agencies: The Council on Environmental Quality and the National Oceanic and Atmospheric Administration of the Department of Commerce. Ten EPA regions have been established which match the boundaries of ten standard federal regions. Decision making powers will be delegated to regional administrators, who will be responsive to state and local problems and needs. The accent is upon prevention rather than cure. Specific developments in the programs involving pesticide regulation and other agricultural pollutants, land use policy, power plant siting, sediment control, waste management, and air quality are discussed in some detail. Man's recognition of the 'whole earth concept' is an important ingredient to any successful earth management. Man must realize that no important social or economic decisions can be made except in terms of the whole earth and its entire panoply of human and material resources. (Strachan-Chicago)
W72-03933

DESIGN WITH PEOPLE: THE QUALITY OF THE URBAN ENVIRONMENT,
Victoria Univ. (British Columbia).
For primary bibliographic entry see Field 06B.
W72-03941

ENVIRONMENTAL REVIVAL: PROMISE AND PERFORMANCE,
Victoria Univ. (British Columbia).
For primary bibliographic entry see Field 06B.
W72-03942

ENVIRONMENTAL EDUCATION: ONE APPROACH TO RESOLVING THE ENVIRONMENTAL CRISIS,
Michigan Univ., Ann Arbor. School of Natural Resources; and Michigan Univ., Ann Arbor. Inst. for Social Research.
For primary bibliographic entry see Field 06B.
W72-03945

PUBLIC OPINION AND ENVIRONMENTAL QUALITY: A REAPPRAISAL,
Simon Fraser Univ., Burnaby (British Columbia).
For primary bibliographic entry see Field 06E.
W72-03946

THE LAKE ERIE CONGRESS - THE PROCEEDINGS OF THE FIRST SESSION.
Great Lakes Research Inst., Erie, Pa.
For primary bibliographic entry see Field 06B.
W72-03947

THE EVERGLADES: WILDERNESS VERSUS RAMPANT LAND DEVELOPMENT IN SOUTH FLORIDA,
Yale Univ., New Haven, Conn. Dept. of Physics.
J. Harte, and R. H. Socolow.
Environmental Analysis, Vol 1, No 1, p 140-164. 1 tab, 13 ref.

Descriptors: *Land development, *Ecosystems, *Water, *Environment, Animals, Airports, Air pollution, Water pollution, Water pollution control, Economics.
Identifiers: *Wilderness, *The Everglades, *South Florida, *Water cycle, *Hydroperiod, Survival.

The existence of the Everglades is being threatened today by the pressure for growth in South Florida. Some of the probable consequences of this growth pressure for the Everglades and for man himself are discussed. Part I describes the ecosystem of the Everglades, and Part II describes the present and proposed projects in South Florida which threaten the survival of the Everglades' park. The cycle of animal life in the park is in rhythm with the hydroperiod, and any severe alternation in the water cycle will threaten the survival of the park. The future health of the Everglades National Park will be affected by any major new international jetport built in South Florida. Some of the issues of the jetport controversy are discussed in detail, and competing

demands for water in Southeast Florida are considered also. The authors believe that the 'god of unrestricted economic growth' will be obeyed until the Everglades Park is ruined. (Strachan-Chicago)
W72-03955

PROTECTION OF OPEN RESERVOIRS AGAINST BIRDS,
Tacoma Dept. of Public Utilities, Wash.
F. D. Emigh.
Journal of the American Water Works Association, Vol 54, No 11, p 1353-1360, Nov. 1962. 3 fig, 3 ref.

Descriptors: *Water treatment, *Gulls, *Water quality, *Ducks (Wild), *Reservoirs, Water pollution, *Reservoir design.
Identifiers: Wire system, Spray system.

Sea gulls and ducks can contribute heavily to contamination of open reservoirs. Tacoma has employed various devices to discourage sea gulls. Only three are presently used. The shotgun method will be abandoned because of bad public relations and hazards created by its use. Stretched wires are the simplest, most economical protection method and require little attention. They keep the gulls from entering in large numbers but do not discourage them from frequenting the coping walls or adjacent areas. The water spray system has proved effective. At least 50% of the water surface should be covered by the spray. Effects of wind on the spray must be considered. The spray system should be a cyclic-operation type, with provision for timing adjustments. (Bean-AWWA)
W72-03960

COOPERATIVE STUDIES FOR PREPARATION OF THE CHICAGO METROPOLITAN AREA RIVER BASIN PLAN.
Economic Research Service, Chicago, Ill.; Forest Service (USDA), Chicago, Ill.; Soil Conservation Service, Chicago, Ill.; and Metropolitan Sanitary District of Greater Chicago, Ill.
For primary bibliographic entry see Field 06B.
W72-03966

POLLUTION CONTROL PROGRAM FOR THE DETROIT REGIONAL WATERSHED.
Detroit Dept. of Water Service, Mich.
For primary bibliographic entry see Field 05D.
W72-03973

TENTATIVE POLLUTION ABATEMENT PROGRAM FOR THE FOX CREEK CANAL, DETROIT, MICHIGAN.
Michigan Water Resources Commission, Lansing; Michigan Dept. of Public Health, Lansing; Wayne County Drain Commission, Detroit, Mich.; Grosse Pointe Park, Mich.; Detroit Corp. Counsel, Mich.; Detroit Dept. o f Public Works, Mich.; Detroit Metro Water Dept., Mich.

Detroit Metro Water Department, Michigan, August 1971. 10 p, 1 fig.

Descriptors: *Water pollution abatement, *Waste water treatment, *Stream improvement, *Sewage treatment, Overflow, Detention, Local governments, Water resources development, Environmental effects, Sanitary engineering, Drainage water, Urbanization, Michigan.
Identifiers: *Combined sewer overflows, *Detroit (Mich), Grosse Pointe Park (Mich), Retention basins.

It was jointly recommended by various interested local agencies that the program for the abatement of pollution in Fox Creek Canal consist of the construction of a retention basin-treatment works. This would extend from the vicinity of Jefferson Avenue near Fox Creek to the vicinity of Conner Creek near Freud Avenue or Essex Avenue. The facility when completed would be located within road right-of-way beneath the road surface. Estimated capital costs are between $20,000,000 and $30,000,000 with at least 80% of such costs to be borne by Federal and State grants. The applicant's share of such cost is to be equitably apportioned among the communities served, including, but not limited to, Grosse Pointe, Grosse Pointe Farms, Grosse Pointe Park, Grosse Pointe Shores, Grosse Pointe Woods, Harper Woods and Detroit. It is proposed that the project be administered and financed under the provisions of the State Drain Act, as amended, (or be accomplished by other mutually acceptable means) with construction to start in 1972-1973. Under separate financing provisions, it is proposed that the Fox Creek Canal be cleaned, embankments improved and facilities installed for continually maintaining the freshness of the waters in the canal. It is further proposed that such work be administered, financed, operated and maintained under the provisions of the State Drain Act, as amended. (Poertner)
W72-03978

POLLUTION ABATEMENT BY FIBER MODIFICATION.
Washington Univ., Seattle. Inst. of Forest Products.
For primary bibliographic entry see Field 05D.
W72-03982

INORGANIC FERTILIZER AND PHOSPHATE MINING INDUSTRIES - WATER POLLUTION AND CONTROL.
Battelle Memorial Inst., Richland, Wash.
For primary bibliographic entry see Field 05B.
W72-03983

ENVIRONMENTAL GUIDELINES FOR ROAD CONSTRUCTION IN ALASKA,
Environmental Protection Agency, College, Alaska, Alaska Water Laboratory.
For primary bibliographic entry see Field 04C.
W72-03984

A PROPOSAL TO DEVELOP A PLAN FOR THE CONSTRUCTION AND TESTING OF WATER POLLUTION FORECASTING MODELS,
Missouri Univ., Columbia. Dept. of Industrial Engineering.
For primary bibliographic entry see Field 05B.
W72-03986

BIBLIOGRAPHY OF WATER QUALITY RESEARCH PROJECT REPORTS.
Environmental Protection Agency, Washington, D C. Office of Research and Monitoring.

EPA Office of Research and Monitoring Water Pollution Control Research Series Report, December 1971. 32 p, 416 ref.

Descriptors: *Bibliographies, *Water pollution control, *Water quality, *Information retrieval, *Publications, Documentation, Projects, Grants, Costs, Financing, Research and development.

This list includes 416 reports concerning current information on water quality research projects. The Publications Branch of Research Information Division, Research and Monitoring, was established in July 1969 for the purpose of disseminating information concerning the advancement of water pollution control technology and knowledge. It serves the need to assemble and readily furnish reports of EPA-sponsored research and development grant, contract, and inhouse projects. Collectively, these reports are called the Water Pollution Control Research Series and describe the results and progress in the control and abatement of pollution in our Nation's waters. They provide a central source of information on the research, development, and demonstration activities in the water research program of the Environmental Protection Agency, through inhouse research and grants and contracts with Federal, State, and local agencies, research institutions, and industrial organizations. (Woodard-USGS)
W72-04032

PRELIMINARY DESIGN OF A MECHANICAL--DRAFT COUNTERFLOW COOLING TOWER,
ARO, Inc., Arnold Air Force Station, Tenn.
For primary bibliographic entry see Field 08A.
W72-04046

LEGAL ASPECTS OF STORAGE FOR WATER QUALITY IMPROVEMENTS,
Corps of Engineers, Washington, D.C. River and Harbor Board.
W. R. Walker, and W. E. Cox.
Journal Water Pollution Control Federation, Vol 43, No 12, December 1971, p 2394-2401, 23 ref.

Descriptors: *Water quality control, *Low flow augmentation, *Legislation, Sewage effluents, Industrial wastes, Industrial water, Irrigation, Federal jurisdiction, State jurisdiction, *Legal aspects, *Storage.

Specific legislation authorizing storage of water for pollution control through low-flow augmentation did not appear until this decade, although enabling legislation containing possible authority for dilution water storage has been in existence for some time. The historical development of legislation concerning this use of water is traced from 1920 to the present. The various Federal agencies that might use this authority and the legal ramifications of such use are presented and discussed. The authority of the states in controlling water and defining water rights in riparian and appropriative regions is presented along with the possible areas of conflicts. It is recommended that: (1) states should consider legislation, where none exists, protecting stored water conveyed through natural streams from other uses; (2) pollution control legislation should be expanded to define water quality standards during low-flow augmentation; (3) the relationship between Federal and state responsibilities toward water should be clarified; (4) specific authorization for the disposal of excess water from all federal reservoirs for water supply and low-flow augmentation should be established; and (5) the policy of requiring power companies to absorb the cost of including water quality storage in private reservoirs should be re-examined. (Goessling-Texas)
W72-04071

URBAN WATER: MULTIPLE-USE CONCEPTS,
Colorado Univ., Boulder. Center for Urban Engineering Studies.
For primary bibliographic entry see Field 06B.
W72-04073

INORGANIC CHEMICALS INDUSTRY PROFILE.
Datagraphics, Inc., Pittsburgh, Pa.

Copy available from GPO Sup Doc for $1.75; microfiche from NTIS as PB-206 308, $0.95. Environmental Protection Agency - Office of Research and Monitoring, Water Pollution Control Research Series, July 1971. 211 p, 62 fig, 23 tab, 89 ref. EPA Project 12020 EJI 07/71.

Descriptors: *Chemical wastes, *Industrial wastes, *Inorganic compounds, Profiles, Productivity, Cost analysis, Construction costs, Operation and maintenance, Neutralization, Equalization, Sedimentation, Growth rates, *Waste water treatment.
Identifiers: *Cost index, *Production capacity.

Data from 59 inorganic chemical plants, as well as data obtained from the Manufacturing Chemist's Association were obtained and analyzed to determine the costs to be incurred by the industry in achieving various levels of pollution abatement by 1974. For the purposes of this study, the inorganic

chemicals industry was defined as including producers of alkalies and chlorine, industrial gases, inorganic pigments, paints and allied products, fertilizers (including ammonia and urea), inorganic insecticides and herbicides, explosives, and other major inorganic chemicals. Total output was estimated at 328.7 billion lbs for 1969 and projected at 455.5 billion lbs for 1974. The historic growth rate has been 1.5 to 2.0 times that of the Gross National Product, but the overall price index of organic chemicals has fallen 2.5% in the recent past. Equalization, neutralization, sedimentation and lagooning are the most widely used treatment processes, and both capital and operation costs for waste industry are presented for 27% and 100% removal of contaminants on a yearly basis from 1969 to 1974. Descriptions of the various production processes and the possible impact that process changes might have on the volume and character of the wastes are presented in detail. (Lowry-Texas)
W72-04099

FEASIBILITY STUDY, UPPER MEANDER CREEK MINE DRAINAGE ABATEMENT PROJECT.
Stanley Consultants, Cleveland, Ohio.

Copy available from GPO Sup Doc for $0.60; microfiche from NTIS as PB-206 232, $0.95. Environmental Protection Agency - Research and Monitoring, Water Pollution Control Research Series, September 1971. 53 p, 16 fig, 8 tab. EPA Project 14010 HBQ 09/71. Contract 68-01-0063.

Descriptors: *Strip mine wastes, *Acid mine water, *Land reclamation, Ponding, Controlled drainage, Revegetation, Administration, Cost analysis, Technical feasibility, Economic feasibility, Hydrology, Aesthetics, Water quality control, Ohio.

The feasibility of a mine drainage control demonstration project for the Upper Meander Creek site in Mahoning County, Ohio, was evaluated by: (1) reviewing the history of mining, mine drainage problems, and mine drainage abatement measures in the area; (2) conducting an inventory of local physical features, hydrology, water quality, and social and environmental factors; (3) developing preliminary engineering features of a workable abatement program in sufficient detail to permit evaluation; and (4) estimating the effectiveness of the project, determining tangible and intangible benefits, and delineate possible beneficial future uses. After the program was formulated it was necessary to: (1) ASSESS THE JURISDICTIONAL FRAMEWORK THROUGH WHICH THE PROJECT COULD BE CARRIED OUT; (2) develop an outline of scheduling and budgeting to assure adequate administrative control; and (3) recommend facilities and a continuing program for surveillance of drainage from the improved area for measuring the demonstration program accomplishments with respect to presently envisioned objectives. The recommended program evolved from this analysis included: (1) elimination of pools of standing water; (2) regrading of the final cut to provide positive drainage; (3) seed bed preparation and planting of acid tolerant trees and grasses; and (4) implementation of beneficial land use features following reclamation. (Lowry-Texas)
W72-04101

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

A STOCHASTIC MULTI-LEVEL OPTIMIZATION TECHNIQUE FOR DESIGN OF A MULTI--PURPOSE WATER RESOURCE PROJECT,
California Univ., Los Angeles. School of Engineering and Applied Science.
F. Mobasheri, A. Klinger, and M. Torabi.

Available from the National Technical Information Service as PB-206 129, $3.00 in paper copy, $0.95 in microfiche. California Water Resources Center. Technical Completion Report UCAL-WRC-W-239, 1971. 59 p, 7 fig, 5 tab, 10 ref. OWRR B-091-CAL (1), 14-31-0001-3059.

Descriptors: *Stochastic processes, *Reservoir system, Streamflow, Hydroelectric production, California, *Model studies, Contracts.
Identifiers: Folsom Reservoir (Calif), American River (Calif).

The main objective of this project was development of a stochastic dynamic model for finding the optimum operating policy of a single multipurpose surface reservoir. The unreliability of forecasting the future streamflow which makes the problem of operation of a reservoir a stochastic process. Traditional methods of the optimization of reservoir operation are based on the critical period of hydrology and deterministic streamflow data for future periods. In this project the real nature of streamflow is taken into consideration by developing probability density functions of the streamflow for each calendar month. The model makes use of these density functions to calculate the probability of transition from a given state and stage to its succeeding ones. The recursive equation for the dynamic programming model is, therefore, a stochastic one. In this model the firm water level contract is used as a parameter to decrease the number of decision and state variables for each stage. For a given water level contract the operation policy for maximization of on-peak hydroelectric production is determined. Changing the firm water level contract, the production possibility function which shows trade off between water and energy production is then calculated. Based on water and energy prices, the optimum contract levels for water and hydro-electricity and the optimum monthly operation policy are determined.
W72-03539

MANAGEMENT PROBLEMS IN METROPOLITAN WATER RESOURCE OPERATIONS,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 06B.
W72-03553

SPACE-TIME SAMPLING OF POLLUTANTS IN AQUIFERS,
Arizona Univ., Tucson. Dept. of Hydrology.
For primary bibliographic entry see Field 05A.
W72-03676

TIME AND FREQUENCY-DOMAIN IDENTIFICATION OF A CAUSAL BIVARIATE STOCHASTIC PROCESS,
Arizona Univ., Tucson. Dept. of Hydrology; and Arizona Univ., Tucson. Dept. of Systems Engineering.
C. C. Kisiel, and L. Duckstein.
Paper presented at the International Symposium on Mathematical Models in Hydrology, Warsaw, Poland, July 26-31, 1971. 4 fig, 1 tab, 5 ref. OWRR B-007-ARIZ (15).

Descriptors: *Stochastic processes, *Rivers, *Flow, *Time series analysis, *Sampling, *Model studies, *Input-output analysis, Systems analysis, Decision making, New Mexico, Mathematical models.
Identifiers: *San Francisco River.

Short-term forecasting of river flows requires specification of either a deterministic or a stochastic model. To ascertain the utility of stochastic models, a bivariate time series analysis of flows at two stations 12 miles apart on the San Francisco River, New Mexico, was performed. Use of multiple input-output pairs indicates that later or earlier flows introduce artificial noise into bivariate correlations and spectra such that either meaningful interpretation is obscured or loss of information occurs. Consideration of individual input-output pairs grouped into seasons then of high, medium and low flows provides more insight into the nature of the nonlinear delays and extent of linear attenuation induced by the system. The coherences were strongest for the flood peaks and for the lower part of the recessions. The effects of sample size (or number of input-output pairs), sampling interval, (2 hours of 15 min) and number of lags on system identification were also considered. The analysis of leads to a series of bivariate time series models for forecasting downstream flows. This method was compared to predictions by regression so as to evaluate information loss and transferability. (Ligon-Cornell)
W72-03677

COMPUTER-AIDED CONFLICT RESOLUTION IN WATER RESOURCE PLANNING: AN ILLUSTRATION,
Colorado Univ., Boulder. Dept. of Civil and Environmental Engineering.
J. E. Flack, and D. A. Summers.
Water Resources Research, Vol 7, No 6, p 1410-1414, December 1971. 8 fig, 7 ref.

Descriptors: *Water resources, *Optimum development plans, *Decision making, *Computer programs, *Basins, Regional analysis, Operations research, Systems analysis design.
Identifiers: *Cognograph, Conflict analysis judgments, Policy formation, Computer graphics.

Regional basin-wide planning includes a wide spectrum of planning objectives and goals to make the best use of water. The specific purpose of the paper was to describe a man-machine strategy for resolving conflicts between water resource decision makers, particularly between panels of representatives of decision makers and influential members of the community concerned. The use of Cognograph, an interactive computer graphics program which used a CDC 280-282 display console in conjunction with a CDC 6400 computer for analyzing cognitive processes, was proposed for the purpose of resolving conflict in water resource decision making. The use of the Cognograph involved (1) a series of objects to be judged which were shown on the graphic display device in the form of bar graphs, and (2) participants (real or simulated decision makers) were asked to make a judgment on a metric scale about each object, e.g. to judge whether the object is desirable or undesirable. To illustrate how Cognograph was applied to water resource decision making, two decision makers were shown a series of 10 hypothetical projects via the display console and as a result the participants were able to formulate a joint decision-making policy that was mutually acceptable. (Ligon-Cornell)
W72-03680

AN EXPERIENCE IN PLANNING: THE SYSTEMS APPROACH,
Corps of Engineers, New York. North Atlantic Div.
H. E. Schwarz, and D. C. Major.
Water Spectrum, Vol 3, No 3, p 29-34, Fall, 1971.

Descriptors: *Water resources, *Systems analysis, *Optimum development plans, Economics, *Social aspects, *Decision making, Estimating, Benefit-cost analysis, Input-output data, Time series analysis, Linear programming, *Model studies.
Identifiers: *Multiobjective planning theory.

Methods and models used in the North Atlantic Region water resource planning process were discussed. The NAR framework plan had 3 purposes: to estimate on a broad scale the demands for and supplies of water resources systems outputs for a 50-year period; to identify priority areas for investment and management plans and programs; and to identify priority areas for further planning and research. Additional objectives were improvement of environmental quality, increase in

national income, and regional development. The planning solution combined systems analysis and multiobjective planning theory. The systems approach utilized computer programs and the multiobjective approach provided various alternative plans. Two mathematical models were developed. A demand model was composed of an economic input-output table, a regression estimate of municipal water demand and arithmetic operations. The second model was a supply, or linear programming model. Its input was derived from the demand model. The supply model determined the minimum cost of supplying required flows, together with an identification of the optimal sources of supply and the number of million gallons per day required from each. Advantages and limitations of the models were discussed. (Markell-Cornell)
W72-03684

A SYSTEMS ANALYSIS OF APPLICATIONS OF EARTH ORBITAL SPACE TECHNOLOGY TO SELECTED CASES IN WATER MANAGEMENT AND AGRICULTURE.
Planning Research Corp., Los Angeles, Calif.

Available from the National Technical Information Service, as N71-28445, $3.00 in paper copy, $0.95 in microfiche. Technical Report, Vol 2, PRC R-1224, November 1969. 313 p, 99 exhibits, 232 ref. NASw-1816.

Descriptors: *Satellites (Artificial), *Systems analysis, *Model studies, *Aircraft, *Cost-benefit analysis, Input-output analysis, Hydrology, Flows, Operations research, *Remote sensing.
Identifiers: Multispectral scanner, Columbia River, Pacific Northwest.

The focus of the study was the formulation and evaluation of feasible future operational system concepts for applying satellite-based remote sensing to improve the management of specific water resources and agricultural activities. A systems analysis of three of the many uses of space technology was undertaken. The case studies related to: (1) the management of the regional demand and supply of water (emphasizing the generation of hydroelectric power, flood control, irrigation, and recreation), (2) the management of the world wheat crop (emphasizing the impact of fluctuations on the United States as the major exporter), and (3) the control information needs to the specifications of satellite-borne sensors and the interpretation and dissemination of results to the users. The four-satellite system proposed could be deployed solely for wheat production management but the benefits could be realized with fewer satellites and no radar. The satellite system made it possible to monitor world wheat production to permit optimal United States adjustments. The wheat rust case required frequent monitoring (every 12 hours) and the use of radar. The water management case required 6-hour coverage and free use of the satellite system. The cost-benefit ratios were substantial and the satellite was shown to be superior to aircraft. (See also W72-03686) (Ligon-Cornell)
W72-03685

A SYSTEMS ANALYSIS OF APPLICATIONS OF EARTH ORBITAL SPACE TECHNOLOGY TO SELECTED CASES IN WATER MANAGEMENT AND AGRICULTURE.
Planning Research Corp., Los Angeles, Calif.

Available from the National Technical Information Service as N71-28446, $3.00 in paper copy, $0.95 in microfiche. Technical Report, Vol 2, Appendixes, PRC R-1224, November, 1969. 540 p, 173 exhibits. NASw-1816.

Descriptors: *Satellites (Artificial), *Systems analysis, *Model studies, *Aircraft, *Cost-benefit analysis, *Input-output analysis, Hydrology, Flows, Operations research, *Remote sensing.

This volume containes 9 appendices that support the Vol. 2, Technical Report. Topics included in these appendices are User Sensor Model-Hydrology, Hydrological Models, System Operation and Benefits, Satellite System Description and Costs, Alternative Information Systems, Noninformation Alternatives, User Sensor Model-Agriculture, Wheat Production Management and Wheat Rust Control. (See also W72-03685) (Ligon-Cornell)
W72-03686

OPTIMIZATION MODELS FOR THE ANALYSIS OF WATER RESOURCES SYSTEMS,
California Univ., Los Angeles. Dept. of Engineering.
R. C. Harboe.
Ph. D. Thesis, 1970. 196 p, 30 fig, 41 tab, 34 ref, 3 append. OWRR B-061-CAL (13).

Descriptors: *Optimization, *Mathematical models, *Reservoir design, *Multiple-purpose reservoirs, *Long-term planning, Water resources, *Dynamic programming, Operations research, Synthetic hydrology, Hydroelectric power, *Model studies.
Identifiers: *Incremental Dynamic Programming.

Mathematical programming models were developed and tested to find optimum design and long-term operation of water resource systems. Several surface water reservoir systems configurations were analyzed: (1) single multipurpose surface water reservoir, (2) two multipurpose surface water reservoirs in parallel, (3) three multipurpose surface water reservoirs with parallel and series linkages and (4) two multipurpose surface water reservoirs in series with a dual-purpose nuclear desalination plant. Historical streamflow records were used to find the optimum long-term operation policies. The objective function for the multiple purpose water systems was expressed in physical terms, namely maximizing on-peak firm energy production. Other objectives were specified as constraints or parameters. The Incremental Dynamic Programming technique solved these models. Local optima were obtained and numerous initial policies used to start iterations in order to obtain different local optima and possibly obtain a global optimum by selecting the best. The models and algorithms were applied to hypothetical water resource systems data to optimize long-term operation policies. The 3 reservoir models yielded optima with at least 6 times the initial policy values for on-peak firm energy. The 2 series reservoir model and dual-purpose nuclear desalination plant improved energy outputs by 30%. (Markell-Cornell)
W72-03688

DECISION UNDER UNCERTAINTY APPLIED TO A HYDROLOGIC PROBLEM,
Arizona Univ., Tucson. Dept. of Systems Engineering.
W. M. Dvoranchik.
Research Report, M. S. Thesis, November 1971. 68 p, 5 fig, 3 tab, 10 ref, 3 append. OWRR B-007-ARIZ (17).

Descriptors: *Decision making, *Risk, *Data collection, *Hydrology, *Optimization, *Cost-benefit ratio, Bridge design, Flood control, Computer programs, Arizona.
Identifiers: *Bayes risk, Simpson's rule, *Rillito Creek (Ariz).

A basis is provided for evaluating the worth of additional data in decision-making. A decision theoretic approach was presented which delineated the components of the decision process along with a quantitative examination of a bridge and pier design problem to show the expected losses from insufficient knowledge and expected gains from additional information. The Rillito Creek was used to illustrate the problem. Design modifications were the variables that necessitated a revaluation of the worth of additional data. A search routine for the minimum of the Bayes risk and expected opportunity loss was used in choosing the structural design. The hydrologic problem involved annual peak flows for a river and their effect on the design problem. Numerical answers were obtained using a CDC 6400 computer although the program is adaptable to other computer systems. A dollar value was assigned to the worth of additional data showing the expected gain from waiting for more information. In the case illustrated, additional information had a low value. (Markell-Cornell)
W72-03690

THE OPTIMIZATION OF WATER RESOURCES DEVELOPMENT, II,
California Univ., Los Angeles. School of Engineering and Applied Science.
W. A. Hall, and W. W-G. Yeh.
Available from the National Technical Information Service as PB-206 300, $3.00 in paper copy, $0.95 in microfiche. California Water Resources Center Completion Report UCAL-WRC-W-183, 1971. 7 p. OWRR B-061-CAL.

Descriptors: *Reservoirs, *Synthetic hydrology, *Water supply, *Streamflow, *Stochastic processes.
Identifiers: *Critical period.

The purpose of this study is to define 'critical period' in conjunction with reservoir design and operation, and then to analyze the usefulness of the concept in the evaluation of deficiencies of water for project planning purposes. Streamflow records from a number of rivers in the United States are analyzed and certain defined characteristics of their various critical periods are derived. These characteristics are shown to be functions of both the active storage and the degree of variation in annual streamflow. A study is made of the significance of critical periods and their associated droughts respecting their use for design purposes. This is done by generating large numbers of equally likely hydrographs of the same as the historical record, and comparing the critical periods and yields of these synthetic records with those found in the historical record. The generated records as a whole had significantly less severity, measured by the decrease in the full record firm yield, than the historical records of the same length. The critical periods also showed a strong tendency for nesting. These observations suggest, but do not prove, that the more severe critical periods observed in historical records may be due to major perturbations of the cause-effect relationships not reflected by the hypothesis of static probability relationship.
W72-03763

DYNAMIC PROGRAMMING MODEL AND QUANTITATIVE ANALYSIS, ROSWELL BASIN, NEW MEXICO,
New Mexico Inst. of Mining and Technology, Socorro. Hydrology Section.
For primary bibliographic entry see Field 02F.
W72-03770

MANAGEMENT ALTERNATIVES IN THE USE OF THE WATER RESOURCES OF THE PECOS RIVER BASIN IN NEW MEXICO,
New Mexico State Univ., University Park. Dept. of Civil Engineering.
J. W. Hernandez.
PB-206 189. New Mexico Water Resources Research Institute, Las Cruces, WRRI, Report No. 12, 1971. 196 p, 42 fig, 41 tab, 53 ref, append. OWRR B-006-NMEX (5) and B-011-NMEX (5).

Descriptors: *Linear programming, *Dynamic programming, *Systems analysis, *New Mexico, Reservoir operation, Reservoir sites, Synthetic hydrology, Water shortage, Water rights, Overdraft, Streamflow, Recharge, River basins, Groundwater basins, Water quality, Saline water, Routing, Groundwater mining, Water storage, Water yield.

Identifiers: *Reservoir routing, *Pecos River Basin, *Roswell Artesian Basin, *Management alternatives, *Decision model, System losses, Intrabasin transfers, Water salvage, Land retirement, Natural discharge, Artificial discharge, Safe yield, Synthetic flow.

The purpose was to identify those general management policies that could lead to enhanced efficiency and effectiveness of the use of the water resources of the Pecos River in New Mexico. The report reviewed the existing situating in the Pecos Basin and in potential value of restudying some of the elements of the supply system. Many conventional techniques used in hydrologic work were employed, but some of the newer and unproven methods were also used, such as synthetic inflow-outflow studies, and the coupling of linear and dynamic programmiing models. Results of the analytical work are presented in a management-decision model for the Roswell Artesian Basin, and in a stochastic model of the storage, routing, and use of available surface water. Four principal recommendations offered were: (1) the level of pumping in the Basin should be reduced by retirement of lands from production, (2) Channel and delta losses between Alamogordo and McMillan Dam should be reduced, (3) Deterioration of the quality of the surface supply from Anton Chico to Santa Rosa should be reduced, and (4) A salinity-routing study should be undertaken to evaluate the combined effects of current and planned water-development projects on the quality of the surface water supply. (Creel-New Mexico)
W72-03771

LINEAR PROGRAMMING APPLICATIONS IN WATER RESOURCES,
Battelle Memorial Inst., Columbus, Ohio. Environmental Planning Group.
N. L. Drobny.
Water Resources Bulletin, Vol 7, No 6, p 1180-1193, December 1971. 1 fig, 39 ref.

Descriptors: *Linear programming, *Systems analysis, Mathematical models, Water resources, Water resources development, Reviews, Bibliographies, Water quality.

Applications of linear programming to water quality and water quantity problems are discussed, and a fairly comprehensive sample of recent literature in these areas is reviewed. Basic elements of linear programming are also discussed. Emphasis is placed on the elements of linear programming that make it a useful tool for analyzing water resource problems and the basic features of various water resource problems that render them amenable to meaningful analysis by linear programming. (Knapp-USGS)
W72-03876

STRUCTURING URBAN TRANSPORTATION PLANNING DECISIONS: AVAILABLE SOCIAL SCIENCE CONSTRUCTS,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
B. G. Hutchinson.
Environment and Planning, Vol 2, p 251-265, 1970. 4 fig, 1 tab, 25 ref.

Descriptors: *City planning, *Analytic techniques, *Decision making, *Political aspects, *Model studies, Planning, Evaluation, Economic efficiency, Access routes, Income analysis, Political constraints, Institutions, Cities, Community development.
Identifiers: *Welfare theory, *Urban transportation, Social science constructs, Environmental quality, Income distribution goals, Political process, Goal formulation.

A welfare-theory-based framework for the evaluation of urban transportation investments is described. An economic efficiency criterion is developed in terms of the community demand schedule for accessibility and for environmental quality. A procedure for modifying this efficiency criterion to reflect income distribution goals is presented. It is argued that the necessary empirical information for this evaluation framework must be derived from the application of some consistent theory of democratic group decisions. A number of models of the political process are then reviewed. Recent experience with several institutional frameworks for planning is discussed and some of the principles of the models are used to evaluate this experience. The contributions that available models of the political process might make to the extension of the welfare-based-evaluation framework are then explored. The elementary extensions presented in the paper provide a basis for studying the goal formulation and weighting processes in particular communities. Comparative studies in a number of urban communities should lead to the development of a meaningful institutional framework for urban transportation planning activities. (Davis-Chicago)
W72-03940

NOTES ON THE DESIGN OF OPERATIONAL MODELS,
Center for Environmental Studies, London (England).
T. A. Broadbent.
Environment and Planning, Vol 2, p 469-476, 1970. 2 fig, 18 ref.

Descriptors: *Model studies, *Mathematical models, *Design, *Design criteria, Structure, Theoretical analysis, Analytic techniques.
Identifiers: *Design principles, *Operational models, Spatial-interaction allocation model, Dimensionality, Separation of variables, System identification.

Problems involved in the practical application of mathematical urban models are discussed. Relatively little attention has been devoted to the design principles involved in applying models to real world data. Design principles, on the experimental side, refer to the identification and definition of the system under study, and thus the meaning to be attached to variables and their measured values. On the theoretical side, reference is made to the formulation of dimensionally correct models, and the construction of equation systems which use appropriate procedures to simplify relationships and take advantage of the structural simplification present in the data, the information in 'observable' variables being used in the most economical and explicit way. With reference to some recent applications of a spatial-interaction allocation model, questions of dimensionality, separation of variables, system identification, and simple structure principles are considered. How these ideas can be utilized to help improve the meaning of model output and generally increase the insight provided by the model is illustrated. (Davis-Chicago)
W72-03943

CYBERNETIC AND GENERAL-SYSTEM APPROACHES TO URBAN AND REGIONAL SCIENCE: A REVIEW OF THE LITERATURE,
Manchester Univ., (England). Centre for Urban and Regional Research.
J. B. McLoughlin, and J. N. Webster.
Environment and Planning, Vol 2, 1970. p 369-408, 332 ref.

Descriptors: *Theoretical analysis, *Urbanization, *Analytic techniques, *Systems analysis, Planning, City planning, Methodology, Regions, Cities.
Identifiers: *General systems theory, *Cybernetics, *Information theory, *Regional science, Systems structure, Systems dynamics, Urban change, Human settlement patterns.

Certain theoretical concepts are introduced including the notion of systems, their structure and behaviour; cybernetics and information theory; the dynamics of systems which evolve and adapt their structure, and the maintenancy of their organization; and the notion of control. Each concept is illustrated with examples drawn from various disciplines. This theoretical framework is related to systems identified in human-settlement patterns. Contributions by regional scientists are noted, various approaches to urban/regional systems analysis are reviewed, and the specific problems of defining elements, interactions, and an appropriate environment are discussed. An attempt is made to identify particular authors and ideas which appear to be the most significant contributions towards the understanding and guidance of change in towns and regions. (Davis-Chicago)
W72-03953

DEVELOPMENT OF A SIMULATION MODEL FOR STORMWATER MANAGEMENT,
Metcalf and Eddy, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 05B.
W72-04022

DOSAG-I, SIMULATION OF WATER QUALITY IN STREAMS AND CANALS. PROGRAM DOCUMENTATION AND USERS MANUAL.
Texas Water Development Board, Austin. Systems Engineering Div.
For primary bibliographic entry see Field 05B.
W72-04047

6B. Evaluation Process

THE VALUE OF WATER USED IN WASHINGTON'S IRRIGATED AGRICULTURE,
Washington State Water Research Center, Pullman.
For primary bibliographic entry see Field 06D.
W72-03537

THE VALUE OF WATER USED IN WASHINGTON'S IRRIGATED AGRICULTURE,
Washington State Water Research Center, Pullman.
For primary bibliographic entry see Field 06D.
W72-03538

MANAGEMENT PROBLEMS IN METROPOLITAN WATER RESOURCE OPERATIONS,
American Society of Civil Engineers, New York.
M. B. McPherson.
Available from National Technical Information Service as PB-206 087, $3.00 in paper copy, $0.95 in microfiche. ASCE Urban Water Resources Research Program, Technical Memorandum No. 14, September 1971. 76 p, 2 tab, 154 ref, 3 append. OWRR C-1536 (No1992) (7).

Descriptors: *Management, *Water resources, *Environment, *Planning, *Decision making, Water pollution control, Standards, Water quality, Water quality control, Droughts, Water reuse utilities, Water supply, Recreation, Waste water treatment, Water treatment, Conservation.
Identifiers: *Management problems, *Policy making, *Intelligence system feasibility, *National urban water policy, Implementation, Private sector, Water use, Public water supply.

The report has two main operating problem themes, (1) intelligence system feasibility, and (2) national urban water policy. Conclusions are addressed primarily to the theme of policy. Conclusions specifically dealing with the feasibility study will be discussed in a succeeding report which will explore the physical capability of existing technology. The topics discussed include: planning and plan-implementation problems, water pollution control, water pollution standards, quality of water supplies, the private sector, use curtailment during droughts, the utilities concept, recreational uses of water supply impoundments, financing public water supplies, wastewater treatment,

water treatment, water re-use, and other conservation measures. (Strachan-Chicago)
W72-03553

FOOD, FIBER AND THE ARID LANDS.
Arizona Univ., Tucson. Office of Arid-Lands Research.
For primary bibliographic entry see Field 03F.
W72-03652

RESOURCE-ALLOCATION PROBLEMS FOR THE DEVELOPMENT OF ARID ZONES,
United Nations Education, Scientific and Cultural Organization, Paris (France). United Nations Development Programme.
For primary bibliographic entry see Field 03F.
W72-03654

THE PAPAGO CATTLE ECONOMY: IMPLICATIONS FOR ECONOMIC AND COMMUNITY DEVELOPMENT IN ARID LNDS,
Papago Office of Economic Opportunity, Sells, Ariz.
For primary bibliographic entry see Field 03F.
W72-03656

BUILDING DESIGN AND PLANNING FOR SELF-SUSTAINING COMMUNITIES IN REMOTE LOCALITIES OF AUSTRALIA'S ARID ZONE,
Melbourne Univ., Parkville (Australia). Dept. of Architecture and Building.
For primary bibliographic entry see Field 03F.
W72-03657

COMPUTER-AIDED CONFLICT RESOLUTION IN WATER RESOURCE PLANNING: AN ILLUSTRATION,
Colorado Univ., Boulder. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 06A.
W72-03680

ECONOMIC ANALYSIS OF PUBLIC WATER SUPPLY IN THE PISCATAQUA RIVER WATERSHED,
New Hampshire Univ., Durham. Water Resources Research Center.
R. H. Forste, and R. L. Christensen.
Journal of The Society for Long Range Planning, Vol 3, No 4, p 75-85, June 1971. 12 fig, 3 tab, 1 append. OWRR A-008-NH (7).

Descriptors: Costs, *Cost analysis, Economics of scale, Diseconomies of scale, Water requirements, *Water distribution (Applied), *Watershed management, Planning, Prices, New Hampshire, Urbanization, Cities, *Water supply, Municipal water.
Identifiers: *Piscataqua River Watershed, Investment.

The southeastern portion of New Hampshire is experiencing a rapid growth in population. Many small semi-rural communities are becoming suburban complexes with mushrooming residential developments. Expanding demands for municipal services create an urgent need for planning efforts that will aid decision makers in the choice among alternative systems for providing municipal services, such as water supplies. The study reviews the characteristics of water supply systems and identifies the economic problems associated with them. The first portion of the study is exploratory in nature, conducted on a theoretical basis. The appendix to the study uses an average cost approach in analyzing the economics of public water supply for 10 public and private water supply systems in the Piscataqua River Watershed (N.H.-Me.). The cost of production and distribution, plant size adjustments, and variation in water use are included.
W72-03764

QUANTITATIVE WATER RESOURCE BASIN PLANING: AN ANALYSIS OF THE PECOS RIVER BASIN, NEW MEXICO,
New Mexico Univ., Albuquerque. Dept. of Economics.
R. C. d'Arge.
Available from the National Technical Information Service as PB-206 186, $3.00 in paper copy, $0.95 in microfiche. New Mexico Water Resources Research Institute, Report No. 8, 1970. 104 p, 6 fig, 69 tab, 43 ref, 10 append. OWRR B-006-NMEX (2) and B-011-NMEX (2).

Descriptors: *Water transfer, *Water management (Applied), *New Mexico, *Economic prediction, Economics, Optimal development plans, Water utilization, Water allocation (Policy), Duty of water, *River basins, Groundwater basins, Surface-groundwater relationships, Conjunctive use, Planning, Inter-basin transfer.
Identifiers: *Activity analysis, *Water projection models, *Pecos River Basin, Intrabasin water reallocation, Marginal value, Intertemporal reallocation, Social Interest Rate, Shadow Prices.

The traditional water-requirements approach to water resource basin planning is explicitly integrated into an activity analysis type of planning model. The model is structured to include sequential interdependencies of surface water utilization, and conjunctive use of ground and surface waters. In addition, both water quality and quantity restrictions are introduced into the model simultaneously. Emphasis is given to the potential for intrabasin water transfer between competitive users, locations, and points in time. Empirical data and requirements projections are generated for the Pecos River Basin; the model is tested, using the Pecos River Basin data; and policy implications of the results are explored. While the model is a highly simplified characterization of the Pecos Basin economy and hydrology, there appeared to be some important policy implications. The more significant of these were (1) the current value and values of water between 1971 and 1990, when measured as contributions to basin product, appear to be relatively low, (2) the transfer model results indicate that no major location transfers of water within the basin need be contemplated, and (3) if transfers between sectors or between crops are necessary, it would be least costly to withdraw small amounts from each acre rather than withdrawing acreage. (Creel-New Mexico)
W72-03767

ECONOMIC FEASIBILITY OF INCREASING PECOS BASIN WATER SUPPLIES THROUGH REDUCTION OF EVAPORATION AND EVAPOTRANSPIRATION,
New Mexico Univ., Albuquerque. Dept. of Economics.
For primary bibliographic entry see Field 03B.
W72-03768

AN ECONOMIC LAND CLASSIFICATION OF THE IRRIGATED CROPLAND IN THE PECOS RIVER BASIN, NEW MEXICO,
New Mexico State Univ., University Park. Dept. of Agricultural Economics.
R. R. Lansford, E. T. Garnett, and B. J. Creel.
Available from the National Technical Information Service as PB-206 187, $3.00 in paper copy, $0.95 in microfiche. New Mexico Water Resources Research Institute, Report No. 7, 1970. 56 p, 15 fig, 31 tab, 39 ref, append. OWRR B-006-NMEX ( ) and B-011-NMEX (3).

Descriptors: *Land classification, *Irrigated land, *New Mexico, *Economic prediction, *Land appraisal, Water quality, Cultivated lands, Aquifers, Groundwater, Groundwater mining, Saline water intrusion, Water rights, Water level fluctuations, Surface water, Agriculture, Soil types, Farm units, Land resources, Resource allocation, Irrigation, River basin development, Economics, Water resources, Salinity, Groundwater basins.
Identifiers: *Economic land classification, *Pecos River Basin, Income expectancy appraisal, Economic indicators, Limitations, Soil productivity, Water quantity, Soil groups, Groundwater quality, Net return, Groundwater levels, Cropping patterns, Enterprize budgets, Shallow aquifer, Artesian aquifer, Groundwater pumpage, Cropped acres, Farmsteads, Irrigation water diversion.

This study of the Pecos River Basin, New Mexico, was to furnish information concerning the geographic location of irrigated cropland with soil and water problems affecting income expectancies. The Cornell system of economic land classification was used as a basis to delineate those areas having slight, moderate, or severe limitations with respect to soil and water quality and/or quantity. Soil and water maps and reports, and an extensive field survey, were combined to construct the maps. Irrigated lands with slight limitations, Economic Class I, accounted for about 31 percent of the irrigated cropland. Those with moderate limitations or Economic Class II, accounted for 43 percent, and those with severe limitations in Economic Class III accounted for about 16 percent of the irrigated cropland. Ten percent of the cropland was not classified. A systematic program of retiring Economic Class III lands would have the least significant effect on the economy of the basin. By transferring irrigation water from Class III to Class II cropland, especially where water quality is a problem, and to potential Class I land, the economic return per acre-foot of irrigation water in the basin could be increased.
W72-03769

ECONOMIC IRRIGATION SCHEDULING AND THE DEMAND FOR IRRIGATION WATER,
For primary bibliographic entry see Field 03F.
W72-03912

WATER, MAN, AND NATURE,
Bureau of Reclamation, Sacramento, Calif.
R. J. Pafford, Jr.
Paper, 22nd Annual American Institute of Biological Sciences Meeting, Colorado State University, Ft. Collins, August 1971. 8 p.

Descriptors: *Planning, *Resource conservation, *Resource development, Biology, Fish, Wildlife, Project purposes, Fish handling facilities, Weather modification, Project planning, *Environmental effects.
Identifiers: *Engineering works, *Biological sciences, Water resources engineering, Skywater project.

The era of resource management to serve the best interests of both man and nature is beginning. Probably the best approach to the problem of water, man, and nature is an interdisciplinary one, and may be the only one that has a reasonable chance of consistent success. Up to the turn of the century, most water projects were single-purpose and locally oriented. They were built to solve problems of water supply or control; their effects beyond the local area were negligible. The have been largely successful; but, as water projects began to grow in size and scope, side effects such as fish and wildlife depression, drainage contamination, and others, had to be considered. Some Bureau projects are given to exemplify the independent and interdisciplinary approaches to water projects. When biologists and engineers pooled their talents, success has been consistent. When interdisciplinary cooperation broke down or did not exist, limited success was achieved at the cost of lost opportunities for better water usage. Changes are taking place rapidly in water resource development policies, and the American public is beginning to expect synergistic results. (USBR)
W72-03917

COMPUTER APPLICATIONS IN DISTRIBUTION,
International Business Machines Corp., Thousand Oaks, Calif.
R. C. Neel.

Journal of the American Water Works Association, Vol 63, No 8, p 485-489, Aug 1971. 5 p, 5 fig.

Descriptors: *Distribution systems, *Computer applications, *Water distribution (Applied), Automation, Automatic control, Computers, Computer programs, Benefits, Systems analysis, Scheduling, Operations, Maintenance, Administration.
Identifiers: Computer capability, Display systems, Computer systems hardware.

Several applications of a computer system for water distribution are given. Each application has its own special requirements, although there are similarities of computer-system requirements. The costs and benefits of using a computer depend on the distribution system and the degree of sharing of similar components. Process-control computers, with control software and extensive displays, are used primarily for water distribution system operation, but many have additional software and hardware to perform other tasks. A computer-system study is needed before selecting a new system to resolve incompatibilities between present and future requirements and to estimate system costs. (USBR)
W72-03920

ALTERNATIVES FOR SALINITY MANAGEMENT IN THE COLORADO RIVER BASIN,
Federal Water Quality Administration, Denver, Colo.; and Federal Water Quality Administration, Alameda, Calif.
For primary bibliographic entry see Field 05C.
W72-03925

LEISURE ORIENTATION SCALE - REPLICATION AND MEASUREMENT ANALYSIS,
Iowa State Univ., Ames. Dept. of Sociology and Anthropology.
D. R. Yoesting, R. D. Warren, and D. L. Burkhead.
Journal Paper No J-6917 of the Iowa Agriculture and Home Economics Experiment Station, Ames, Iowa, August 1971. 26 p, 7 tab, 4 ref.

Descriptors: *Analysis, *Measurement, *Statistics, *Statistical methods, Reliability, Correlation analysis.
Identifiers: *Leisure orientation scale, *Burdge leisure orientation scale, *Replication analysis, Validity, Samples, Intercorrelation, Means, Standard deviations, Variables, Iowa.

A replication of the Burdge leisure orientation scale was performed with two independent Iowa samples. The 11-item scale was examined for reliability and validity by using various statistical techniques. The scale provided consistent results for both samples, but reliability and validity were increased by using only five of the items. Reliability coefficients of .62 and .63 were obtained from the two samples, respectively. The measurement criteria included: reliability coefficients, item-to-total correlations, intercorrelations of individual items, examination of the means and standard deviations of each item, examination of item correlations to various independent variables, and criterion oriented validity. (Strachan-Chicago)
W72-03926

GENERATING PROJECTS FOR URBAN RESEARCH,
Pennsylvania Univ., Philadelphia. Dept. of City and Regional Planning.
B. Harris.
Environment and Planning, Vol 2, p 1-21, 1970. 8 ref.

Descriptors: *Research and development, *City planning, *Planning, *Decision making, Optimization, Optimum development plans, Design, Cities.
Identifiers: *Urban process, Anticipatory decision making, Alternatives, Policy.

An overview of the author's derivation of the most productive areas for urban research is provided. Several features of urban planning which influence the nature of urban research are identified: (1) planning is anticipatory decision-making, (2) many planning decisions are essentially irreversible, (3) planning decisions for cities are at a scale which does not permit experiment, and (4) planning has a strong drive toward optimality. The first general topic is the understanding of the urban process, together with the role of that understanding in planning. The second general topic is the problem of generating a limited number of alternative policies which may be considered to be in some sense optimal - in part, the problem of urban design. In each case, the nature of the problems associated with the topic is explored, and a number of suggestions are made for fruitful directions for research. (Davis-Chicago)
W72-03927

INVOLVING CITIZENS IN WATER RESOURCES PLANNING: THE COMMUNICATION-PARTICIPATION EXPERIMENT IN THE SUSQUEHANNA RIVER BASIN,
Michigan Univ., Ann Arbor. Dept. of Urban Planning.
Thomas E. Borton, and Katherine P. Warner.
Environmental and Behavior, Vol 3, No 3, p 284-306, September 1971. 13 tab, 21 ref.

Descriptors: *Planning, *Water resources, *Communication, Social aspects, Political aspects, Decision making, Formulation, Inter-agency cooperation, Research and development.
Identifiers: *Citizen participation, *Susquehanna river basin study, *Public involvement, Public opinion, Water resource professionals, Planners, Plan formulation, Public involvement mechanisms.

The Susquehanna Communication-Partcipation Study focused on means of achieving more effective two-way communication between technical planners and the affected publics during a comprehensive water resources planning effort. The research team assisted in the design and evaluation of the public involvement program mechanisms used by the Susquehanna River Basin Study Coordinating Committee. Important findings of the communication-participation study included a convergence in agency planner and local opinion leader problem perceptions following the Coordinating Committee's public information program, a greater reliance by local people on contacts with water resource professionals as sources of information subsequent to the Coordinating Committee program, and the substantially greater amounts of information on which to base plan evaluations which those who attended public information program meetings felt they had received as contrasted with the responses of nonattendees. The reactions of agency planners and local opinion leaders following the public information program lend strong support to increased use of public involvement mechanisms, like workshops, throughout the plan formulation process. Such mechanisms provide improved opportunities for direct two-way communication between planning professionals and members of the public. (Davis-Chicago)
W72-03928

BEHAVIORAL ASPECTS OF WATER MANAGEMENT: A PARADIGM AND A CASE STUDY,
Waterloo Univ. (Ontario). Div. of Environmental Studies.
B. Mitchell.
Environmental and Behavior, Vol 3, No 2, p 135-153, June 1971. 1 fig, 13 tab, 15 ref.

Descriptors: *Water resources, *Water management, *Behavior, *Methodology, *Decision making, Environment, Research and development, Attitudes, Social values, Social aspects, Political aspects, Organizations, Legislation, Water pollution, Planning.
Identifiers: *Environmental behavior research, *Policymaking, Perceptions, Professionals, Professional decision makers, Public participation, Ontario.

Several recent surveys of environmental behavioral research are summarized. Concern is expressed about the lack of well-defined theory and methodology, the fragmentation of research, and the relevance of studies for environmental policy-making. A framework is presented which might help to relate environmental behavioral studies from micro-level investigations about individual perceptions, attitudes and behavior to macro-level studies concerning legislation, organizations, decision processes and decision situations. A case study of some behavioral aspects of water pollution and decision-making in southwestern Ontario is then used to illustrate how the proposed framework relates different components of behavioral inquiry and also makes explicit the input which such findings could have for policy-maksng. In the case study, two hypotheses are tested. First, a hypothesis of differences of attitudes between professional decision makers and the lay public toward water pollution and public participation is tested and confirmed. Second, a hypothesis of differences between sub-groups of the lay public, based upon place of residence (urban, urban-rural, rural), toward cognitive, affective and behavioral variables is tested and rejected. The implications of these findings for research, planning and policy-making are then considered. (Davis-Chicago)
W72-03929

IDENTIFICATION OF MANAGEMENT AND PLANNING PROBLEMS OF URBAN WATER RESOURCES IN THE METROPOLITAN AREA OF GREATER SAN ANTONIO,
Texas A and M Univ., College Station. Water Resources Inst.
J. K. Garner, and C. S. Shih.
Technical Report No 39, September 1971. 122 p, 37 fig, 7 tab, 2 append.

Descriptors: *Decision making, *Management, *Planning, *Water resources, River basins, Economics, Population, Surface waters, Groundwater, Probability, Texas, Cities, Regions, Flood control, Water quality.
Identifiers: *San Antonio (Tex), *Urban water resources, *Metropolitan area, Regional characteristics, Quantitative and qualitative information.

The research presented involves the region incompassed by the San Antonio river basin. A brief summary of the regional economy, demography, and regional characteristics is included. Quantitative and qualitative information relating to the inventory and planning control for both surface and groundwater resource management of the San Antonio area are presented. Emphasis is upon the identification of the probabilistic nature of various decision making parameters of water resource management. Individual chapters include: overnmental organization; water quality; groundwater resources; recreation; flood control. (Strachan-Chicago)
W72-03930

ENVIRONMENTAL PERCEPTIONS AND ATTITUDES OF ENGINEERS AND PUBLIC HEALTH OFFICIALS,
Victoria Univ. (British Columbia).
W. R. Sewell.
Environment and Behavior, Vol 3, No 1, p 23-59, March 1971. 1 fig, 12 tab, 31 ref.

Descriptors: *Attitudes, *Social values, *Social aspects, *Management, *Decision making, Administration, Planning, Environment, Air pollution, Water pollution, Formulation, Engineering, Public health, Institutions.
Identifiers: *Resource management, *Professionals, Public health officials, Engineers, Environmental quality management, Public support, Public opinion, Environmental quality.

Considerable reliance is placed upon professionals as 'experts' in resources management to define problems, recommend solutions, and to ensure that the latter are implemented. This has been especially the case with environmental quality problems, such as water pollution and air pollution. Recently, however, there has been increasing skepticism about the role which professionals play in this connection, due in part to the fact that they have sometimes made important errors in identifying problems and in assessing likely public support for recommended solutions. Among the various groups of professionals that have traditionally been concerned with environmental quality problems, particular reliance has been placed upon engineers and public health officials. The engineers, for example, tended to perceive water pollution as an economic problem, which could be solved by applying the appropriate technology. The public health officials tended to perceive it mainly as a health problem which should be dealt with by the imposition of regulations to maintain a specific chemical composition. The public, however, may not perceive that a problem exists at all, and even if it does, it may not perceive the problem either as one of economics or of health. There may also be important differences in views as to the role of the public in decision-making. The studies showed that professionals are typically not only skeptical about involvement, but also about the potential contribution of other professionals to the definition and solution of problems. The studies indicate some important changes in institutions concerned with environmental quality management are needed. (Davis-Chicago)
W72-03931

DECISION-MAKING IN COMMON PROPERTY RESOURCES,
Resources for the Future, Inc., Washington, D.C.
E. T. Haefele.
Journal of Soil and Water Conservation, Vol 26, No 4, July-August 1971, p 132-134. 2 photo, 6 ref.

Descriptors: *Decision making, *Resources, *Water, *Land use, *Conservation, *Environment, *Governments, Values, Organizations, Management, Competing uses.
Identifiers: *Policy making, *Common property resources, *Development, *Political parties, Legislatures, Executive agencies.

The American citizen can exert control over competing users of common property resources of water and publicly managed lands. The heart of the conflict is a question of who decides what emphasis will be given to development or preservation of a particular common property resource. Many of the hard decisions about the environment have become the domain of executive agencies. The result of this change in the decision making process has made for less effective public participation in important decisions. A conflict over values and goals has become a paramount issue in environmental development. Local value conflicts, which cannot be resolved through the planning process of a higher echelon executive government, result in an impasse in planning and development, as for example highway construction in urban areas, and the location of dams and power plants. The author contends that the search for the 'mythical decision-maker' must be terminated. Resolution of value conflicts can only come through legislative processes in governments of general jurisdiction. A more difficult problem will be to define the boundaries of the legislatures over current problems. Political parties are the sole means of organization for citizens and serve as a medium through which interests can be assessed and evaluated. This generation must redress the balance between the executive and legislative branches of government, which will ultimately resolve the problems of common property resources use. (Strachan-Chicago)
W72-03934

MYTHS IN WILDERNESS DECISION-MAKING,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
G. H. Stankey.
Journal of Soil and Water Conservation, Vol 26, No 5, September-October 1971, p 183-188. 1 fig, 1 tab, 2 photo, 25 ref.

Descriptors: *Decision making, *Planning, *Recreation, *Recreation facilities, *Costs, *Multiple purpose, Management, Values, Esthetics, Income.
Identifiers: *Wilderness, *Wilderness use, *Wilderness users, *Multiple use, Socioeconomic characteristic, Management priorities.

Three questions relating to wilderness decision making are discussed: (1) Are wilderness users a wealthy elite. (2) Is wilderness incompatible with the concept of multiple use. (3) Is the situation approaching where a large share of public lands will be locked up' as wilderness. Some conclusions are stated. The higher income categories are disproportionately represented among wilderness areas, while costs associated with wilderness recreation appear to be comparable or lower than those associated with other outdoor recreation activities. Costs incurred by wilderness enthusiasts are influenced more by the particular desires and preferences of the individuals than by their incomes. Attempts to explain wilderness use solely in terms of a single socio-economic characteristic lead to erroneous conclusions. Wilderness management is a creative planning challenge. The complex administrative and research problems involved with wilderness management will provide a more accurate assessment of the effects of any given decision on users, and a more efficient means of establishing management priorities. A tabulation is presented which tries to delimit the maximum acreage potentially available for study as possible wilderness areas. (exclusive of Alaska). From a national perspective, this potential wilderness acreage represents just 3 percent of the country. Rapid growth in the size of the wilderness system can be expected within the next decade with the maximum extent being reached. Good wilderness decision making demands objective analysis of the wilderness and its esthetic, scientific, and recreational values, as well as values for alternative uses. (Strachan-Chicago)
W72-03935

ECOLOGICAL EVALUATION OF LAND FOR PLANNING PURPOSES,
Nature Conservancy, London (England).
C. R. Tubbs, and J. W. Blackwood.
Biological Conservation, Vol 3, No 3, p 169-172, April 1971. 1 fig.

Descriptors: *Conservation, *Land, *Environment, *Planning, *Evaluation, *Values, Wildlife, Wildlife habitats, Wildlife conservation, Wildlife management, Application method.
Identifiers: *Ecological evaluation, *Flora and fauna, Hampshire, England.

The reservation of areas of land for nature reserves is an inadequate means of conserving even a representative sample of any small but populous country's flora and fauna. The conservationist must evaluate the relative floristic and faunistic values of land in a form which is readily interpretable by planners and is, at the same time, comparable to other information. Such a technique of evaluation for planning purposes was developed in Hampshire, England and has been practically applied to a variety of planning studies undertaken in the Planning Department of Hampshire County Council since 1966. The method consists of subdividing an area into 'ecological zones'. Each 'ecological zone' is assigned a value according to specific criteria. This method expresses broadly the relative importance of land for wildlife and wildlife habitats and is a useful instrument of conservation in Hampshire. The method should be tested in other densely-populated regions of the world. (Strachan-Chicago)
W72-03936

REGIONALIZATION OF NATIONAL PLANNING - SOME METHODOLOGICAL ISSUES,
Bergen Univ. (Norway). Inst. of Sociology.
T. Hermansen.
Environment and Planning, Vol 2, p 429-442, 1970. 4 fig, 54 ref.

Descriptors: *Methodology, *Planning, *Decision making, City planning, Community development, Political aspects, Institutional constraints.
Identifiers: *National planning, *Regional planning, Regional resources, External economies, Physical planning, Decision making authority.

Methodological issues arise when national planning is attempted which is regionalized and integrated with the traditional forms of physical and community development planning at the regional level. Distinctions are made between control and operational decisions and between analytical target planning and institutional planning. Decisions are furthermore classified according to levels in the decision-making hierarchy, and according to their sectoral and spatial dimensions, resulting in a multi-level, multi-sectoral, and multi-regional system of decision making and planning activities. The key problem arising is that of distributing decision-making authority among the decision units and superimposing a planning and information exchange system that not only guarantees consistency, but also ensures efficiency in intersectoral growth patterns as well as with respect to location of project and utilization of regional resources and external economies. (Davis-Chicago)
W72-03939

DESIGN WITH PEOPLE: THE QUALITY OF THE URBAN ENVIRONMENT,
Victoria Univ. (British Columbia).
J. Porteous.
Environment and Behavior, Vol 3, No 2, p 155-178, June 1971. 5 fig, 3 tab, 46 ref.

Descriptors: *Environment, *Cities, *City planning, *Planning, *Psychological aspects, *Behavior, *Design, Design criteria, Attitudes, Social values, Resource development, Community development, Model studies, Decision making.
Identifiers: *Urban environmental quality, *Behavioral concepts, Cognitive maps, Territoriality, Perceptions, Urban designers, Policymaking.

All urban problems have an environmental quality component. Urban environmental quality research has been discouraged until recently by the complexity of the urban scene. In view of the latter, three behavioral concepts are discussed at three scales: at the city scale, cognitive representations of the urban environment (mental maps); at the neighborhood scale, concepts of territoriality and activity systems; and at micro-scale, the determination of behavior by the built environment. In each case the relationships between environment and behavior are explored. In particular, the substantial differences between the perceptions, attitudes, and actions of urban designers and their user-client, the public, are emphasized. In this context the evolution of the planning process is considered as a developmental model. The present state of the art indicates a need for future investigation of the public's use of designed space, the belief-systems of both planners and the public, and means by which the latter may be incorporated as participants into the planning, designing and policy-making processes. (Davis-Chicago)
W72-03941

ENVIRONMENTAL REVIVAL: PROMISE AND PERFORMANCE,
Victoria Univ. (British Columbia).
W. R. D. Sewell, and D. Foster.
Environment and Behavior, Vol 2, No 3, p 123-134, June 1971. 32 ref.

Descriptors: *Environment, *Political aspects, *Social aspects, *Attitudes, *Social change, Social values, Governments, Industries, Psychological aspects, Decision making, Political constraints, Aesthetics.
Identifiers: *Environmental quality, *Environmental deterioration, Earth day, Environmental reform.

The growth of concern over environmental deterioration is reviewed, with particular emphasis placed upon the events of the last decade. It is pointed out that although all sectors of society are campaigning for their environmental rights, few are willing to accept their responsibilities. In consequence the mass exhibitionism accompanying Earth and Survival Days has had little real effect in reducing the decline in environmental quality. Both governments and private industry have been more concerned with creating the image of reform than with reform itself. How long society is able to indulge itself in this way depends upon the most delicate of our physical systems. Man's capacity to tolerate adverse environmental change may prove to be his final weakness. (Davis-Chicago)
W72-03942

SOCIAL POLICY ANALYSIS AS THE INTERPRETATION OF BELIEFS,
Massachusetts Inst. of Tech., Cambridge.
M. Rein.
Journal of the American Institute of Planners, Vol 37, No 5, p 297-310, September 1971. 47 ref.

Descriptors: *Social aspects, *Attitudes, *Social values, Social needs, Social change, Institutional constraints, Evaluation, Decision making, Programs, Priorities, Planning.
Identifiers: *Social policy analysis, *Policy, Implementation.

Social policy is concerned with the integration of values, the principles by which these values are translated into policies and programs, assessments of the outcomes of implementing these principles in terms of the values asserted, and the search for strategies of feasible change which promise a better fit between values, principles, and outcomes. One aspect without the others is not policy analysis. Yet, current efforts have failed to integrate effectively these tasks thus raising questions about whether social policy is a legitimate discipline. Rather than prematurely forcing a grand snythesis, this article tries to extend our understanding of the often partisan nature of policy analysis. Specifically, it illustrates how beliefs intrude at each level of analysis: in definitions of the purposes of policy, in the priorities assigned, in the institutional forms which translate beliefs to programs, in the evaluation of outcomes, and in assessments of what changes are politically feasible. The conclusion that there is no one true policy analysis frustrates the development of an independent discipline, but suggests a stance that analysts of policy might follow. (Davis-Chicago)
W72-03944

ENVIRONMENTAL EDUCATION: ONE APPROACH TO RESOLVING THE ENVIRONMENTAL CRISIS,
Michigan Univ., Ann Arbor. School of Natural Resources; and Michigan Univ., Ann Arbor. Inst. for Social Research.
James Swan.
Environment and Behavior, Vol 3, No 3, p 223-229, September 1971. 4 ref.

Descriptors: *Social aspects, *Environment, *Social values, *Social change, *Education, Decision making, Priorities, Research and development, Social needs, Attitudes, Cultures, Society, Government, Political aspects.
Identifiers: *Environmental education, *Environmental crisis, Environmental problems, Biophysical environment.

The 'environmental crisis' is the product of a series of human decisions which has created our present society. Major factors which have led to the increased public attention given to the problem are more information about the nature of the environmental crisis from increased scientific monitoring equipment, and new social values which place a higher priority on this new information. To avert future problems as well as solve current ones it is argued that it will require social change, one component of which is environmental education which must address itself to resolving environmental problems. The major objectives of environmental education are to help individuals acquire: (1) a clear understanding that man is an inseparable part of a system, consisting of man, culture, and the biophysical environment, and that man has the ability to alter the interrelationships of this system; (2) a broad understanding of the biophysical environment, both natural and man-made, and its role in contemporary society; (3) a fundamental understanding of the biophysical environmental problems confronting man, how these problems can be solved, and the responsibility of citizens and government to work toward their solution; and (4) attitudes of concern for the quality of the biophysical environment which will motivate citizens to participate in biophysical environmental problem-solving. (Davis-Chicago)
W72-03945

THE LAKE ERIE CONGRESS - THE PROCEEDINGS OF THE FIRST SESSION.
Great Lakes Research Inst., Erie, Pa.

July 12-14, 1971, Erie, Pennsylvania. 41 p, 5 append.

Descriptors: *Planning, *Decision making, *Environment, *Control, *Conservation, *Water.
Identifiers: *Pollution control, *Lake Erie Congress, *Policy making, Resolutions, Private and public sectors, Community interest, Committees, Questionnaires.

The Lake Erie Congress was envisioned as a novel and intensive effort to gather together an entire community of direct interest in Lake Erie from both the private and public sectors of the United States and Canada. The independent work of six basic committees presented eighteen resolutions which met the approval of the Congress as a whole. This report chronicles the structure and process of the Lake Erie Congress. The eighteen resolutions of the Lake Erie Congress, the committee papers which contain the framework of the resolutions, and the congressional keynote addresses, are presented. The Appendices include (1) a summary of a post-congressional questionnaire, (2) a synopsis of the development of a macro-system decision-making process for addressing environmental problems, (3) committee task descriptions, (4) the congressional program schedule, and (5) a list of the participants in the Lake Erie Congress. (Strachan-Chicago)
W72-03947

CONCEPTS IN PLANNING FOR WATER RESOURCES DEVELOPMENT AND CONSERVATION - THE AMERICAN EXPERIENCE,
Cornell Univ., Ithaca, N.Y.
L. S. Hamilton.
Biological Conservation, Vol 3, No 2, p 107-112, January 1971. 3 fig, 3 ref.

Descriptors: *Decision making, *Water, *Planning, *Water resources development, *Conservation, *Integrated control measures, *Flood control, *Management, Land, Multiple purpose, Dams, Groundwater, Administration, Water pollution.
Identifiers: *Services, *Hydrologic unit, Basin-wide programme, Comprehensive regional development.

Originally, water resources development was primarily concerned with obtaining one of the services which a stream or river had to offer. As pressures on the available water resource are intensified, attention must be directed to establishing integrated control over the flow of water in a hydrologic unit in order to increase the net amount of services provided. This represents a shift from single-service development to water management with a focus on hydrologic units instead of services. Eight concepts in water resources planning which have gradually evolved in the United States are described. It is hoped that these concepts will prove applicable in Australia and elsewhere. The eight concepts are: (1) Land and water are related, (2) Multiple-purpose dams, (3) The basin-wide programme, (4) Comprehensive regional development, (5) Ground-water is ignored, (6) Unified administration, (7) Cleanliness is next to godliness, and (8) Fragile values in flowing streams. (Strachan-Chicago)
W72-03948

URBAN STUDIES AND ACTION RESEARCH,
Northwestern Univ., Evanston, Ill.
H. P. Friesema.
Urban Affairs Quarterly, Vol 7, No 1, p 3-11, September 1971. 3 ref.

Descriptors: *Urban sociology, *Evaluation, *Political aspects, *Research and development, Cities, City planning, Governments, Planning, Decision making.
Identifiers: *Urban affairs, *Action-oriented research, *Municipal government, Urban political systems, Commitment, Over commitment, Social scientists, Policy making, Implementation.

In recent years, there has been increased action-oriented research about urban problems. In no other field of academic pursuit has the demand for relevance been more actively pursued. A point of self-consciousness must be reached among participants in the area of action research in urban affairs. Some of the precedents and experiences of political scientists and others who are involved in 'municipal government' are examined. The commitments of students of 'municipal government' have had substantial impact upon urban political systems, manifest in such programs as civil service reform, the short ballot, nonpartisanship, the city manager plan, and metropolitan reform. Problems with the involvement with municipal government have included: non-examination of fundamental questions about the nature of the urban political systems, over commitment to training, and the client-orientation of the academics. Urban social scientists must become their own popularizers and activists. Overcommitment to action will ultimately hinder theoretical development. The boundaries and dangers of overcommitment must be defined. (Strachan-Chicago)
W72-03949

SOME SOCIAL ACCOUNTING ASPECTS OF WATER RESOURCE USE AND CONTROL,
Auburn Univ., Ala. Dept. of Economics.
D. R. Street, and R. R. Criss.
Research Report, n.d, 7 p, 2 ref. OWRR B-012-ALA (1) and B-029-ALA (4).

Descriptors: *Water resources, *Control, *Decision making, *Planning, *Resource allocation, *Environment, Social aspects, Economics, Psychological aspects, Feasibility.
Identifiers: *Accounting aspects, *Use, *Policy making, *Optimum water resource policy, Social Sciences, Hard Sciences, Interdisciplinary research, 'Pooling-of knowledge approach', Efficiency.

Increased public awareness of the socio-economic aspects of water resource use has directed attention toward development of an improved mechanism for decision making on resource allocation affecting the environment. The concepts of social accounting in determining the feasibility of new projects and the efficiency of past projects are evaluated. Further knowledge is needed about the monetary phase of social accounting as well as about the attributive and descriptive features of

the economy in a qualitative context. Future progress in the area of social accounting depends largely upon the interfaces of the hard sciences and the social sciences. Interdisciplinary research is important to the assessment of economic alternatives. Social accounts specialists have not bothered, in the past, to make use of the physical sciences, while physical scientists have ignored the sociological and psychological phenomena which influence the feasibility of certain projects. A 'pooling-of-knowledge' approach is essential to the establishment of an optimum resource policy which will maximize the net social gain. (Strachan-Chicago)
W72-03951

MULTI-ORGANIZATIONAL DECISION PROCESS IN THE PLANNED EXPANSION OF TOWNS,
Institute for Operational Research, London (England).
J. K. Friend, and J. M. H. Hunter.
Environment and Planning, Vol 2, 1970, p 33-54. 3 fig, 1 tab, 13 ref, 7 append.

Descriptors: *Decision making, *Community development, City planning, Cities, Planning, Population, Employment, Coordination, Interagency cooperation, Political aspects, Organizations, Political constraints.
Identifiers: *Multi-organization, *New towns.

The concept of the 'multi-organization' is used to obtain a clearer view of the problems of decision-making in one field of public planning where the pattern of organizational responsibilities is exceptionally diffuse: that relating to the planned expansion of towns to channel the pressures for change within a region. Four basic types of multi-organizational activity are identified, concern with the redistribution of population and employment within a region, the negotiation of local agreements, the coordination of local operations, and the coordination of external authorizations by different government agencies. Some of the main characteristics of these four activities are identified, and it is argued that a basis for predicting the effectiveness of alternative organizational patterns can be developed through the analysis of different sources of uncertainty as perceived by those actually involved in the decision process. (Davis-Chicago)
W72-03952

ADJUNCTIVE PLANNING AND URBAN DEVELOPMENT POLICY,
Wisconsin Univ., Milwaukee.
D. A. Rondinelli.
Urban Affairs Quarterly, Vol 7, No 1, p 13-39, September 1971. 2 tab, 43 ref.

Descriptors: *Planning, *Decision making, *Analysis, *Organizations, Research and development, Resources, Approximation method, Evaluation, Cities, Regions.
Identifiers: *Adjunctive planning, *Urban development policy, *Regional development policy, *Policy making, Variables, Interaction, Opportunity loss, Policy making integration, Mobilization of resources, Implementation.

The most widely accepted principles and assumptions of American planning theory are totally inadequate to meet the complexities of policy making for urban and regional development. Six 'prescriptions' which have guided the analysis and organization of urban and regional development over the past fifty years are (1) Rational Comprehensiveness (2) Hierarchical Integration (3) Nonpolitical Objectivity (4) Central Coordination (5) Technical Objectivity and Regulatory Control, and (6) Focus on Structural Development. The future thrust of planning theory must explicate the interaction of variables and use them to guide urban and regional development. Adjunctive planning is a process that seeks to mobilize disparate resources and, by focusing them on remediable aspects of problems, to move marginally through successive approximation away from unsatisfactory states of development. Four broad sets of adjunctive planning functions are (1) Improvement of the quality of regional policy making - intelligence and analysis (2) Reduction of opportunity loss (3) Promotion of policy making integration, and (4) Mobilization of resources. (Strachan-Chicago)
W72-03954

COOPERATIVE STUDIES FOR PREPARATION OF THE CHICAGO METROPOLITAN AREA RIVER BASIN PLAN.
Economic Research Service, Chicago, Ill.; Forest Service (USDA), Chicago, Ill.; Soil Conservation Service, Chicago, Ill.; and Metropolitan Sanitary District of Greater Chicago, Ill.

Metropolitan Sanitary District of Greater Chicago, Chicago, Illinois, September 1971. 35 p, 1 fig.

Descriptors: *Planning, *Illinois, *Administration, *River basin development, *Watershed management, Urbanization, Cities, Surveys, Water resources development.
Identifiers: *Greater Chicago (Ill), *Metropolitan Chicago (Ill), River basin plan.

The Board of Trustees for the Metropolitan Sanitary District of Greater Chicago (MSD) requested the United States Department of Agriculture (USDA) to make a cooperative River Basin Investigation and Survey of the six watersheds draining the metropolitan area. These watersheds include North Branch of the Chicago River, Little Calumet River, Calumet-Sag Channel, Poplar Creek, Salt Creek, and Des Plaines River. They are the watersheds in Cook County and the watersheds with streams flowing into Cook County. The study will determine the water and related land resource problems and needs, and propose and evaluate solutions and alternatives to problems associated with watershed protection, flood damage reduction, urban water management, fish and wildlife, recreation, water quality, environmental enhancement and other related purposes. In addition, the extent to which action is needed beyond the scope of available going programs will be determined. The major elements of the USDA survey will include the following: an inventory and appraisal of the available land, water, and related resources, their quality, quantity, and existing problems; an appraisal of the economic base and projections of economic development for the years 1980, 2000, and 2020 drawing upon available projects where applicable; translations of projections into needs for water and land resource development; identification of coordinated projects and program leading to short and long range solutions; and formulation of development program. Completion is scheduled for June 30, 1976. (Poertner)
W72-03966

DECISION MODELS FOR MINIMIZING THE COST INFORMATION ON ERROR IN ESTIMATING BENEFIT-WATER RELATIONSHIPS WITH SPECIAL APPLICATIONS TO IRRIGATION,
New Mexico State Univ., University Park. Water Resources Research Inst.
R. C. d'Arge.
Available from the National Technical Information Service as PB-206 198, $3.00 in paper copy, $0.95 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, December 1971, 22 p, 2 fig, 18 ref. OWRR A-017-NMEX (2).

Descriptors: *Economic efficiency, *Water allocation (Policy), *Preferences (Water rights), Prior appropriation, Priorities, Riparian rights, Natural flow doctrine, Beneficial use, Decision making, Cost allocation, Irrigation efficiency, Planning.
Identifiers: *Decision models, *Water doctrines, *Benefit-water relationships, Basin planning, Pro rata doctrine, Water shortages.

An attempt is made to demonstrate that allocation rules resulting from water doctrines are integrally related to concepts of economically efficient allocations. It is also argued that water doctrines should be viewed as important choice or decision variables in water resources basin planning. A simplified interpretation and a hypothetical case study were used to analyze systematically the merits, in terms of efficiency, of alternative water doctrines. Conclusions were that no a priori substantiation of the superiority of one doctrine over another can be made without complete knowledge of each user's economic loss-withdrawal relationship's, sequential interdependence, and certain prescribed orderings between economic losses and the preferential ranking dictated by the prior appropriations doctrine. Under the alternative water doctrines studied, both the presence and degree of sequential interdependence influences the divergence in allocations between users. The higher the degree of interdependence, generally, the closer together allocations of water will be under the pro rata and prior appropriations doctrines. In situations where sequential use is not present, and losses generated for individual users from shortages are not too dissimilar, the pro rata doctrine appears to be, in general, the 'second best' water doctrine, i.e., in lieu of an efficient market. (Creel-New Mexico)
W72-03988

THE LAKE NOQUEBAY PROJECT: AN EXPERIMENT IN PROBLEM-ORIENTED RESEARCH AND COMMUNITY SERVICE,
Wisconsin Univ., Green Bay.
A. J. Bedrosian, W. O. Bennett, J. E. Berry, R. B. Ditton, and W. J. Johnson.
Special publication, June 1971. 9 p. OWRR B-046-WIS (1).

Descriptors: *Management, *Plants, *Recreation, Lakes, Water quality economics, Wisconsin.
Identifiers: *Interdisciplinary approach, *Integrated study, *Lake Noquebay (Wis).

The Lake Noquebay project is a study of a recreational lake designed to develop and demonstrate an action program in water-resource management. An initial phase designed to obtain background information and isolate management problems, revealed the following areas of concern: (1) excessive growth of aquatic plants in three areas of the lake rooted in accumulations of organic muck; (2) maintenance of high water quality in the face of increasing recreational pressure; (3) economic problems of seasonality, winter unemployment, and marginal business in the tourist industry; and (4) complex legal and politcal problems due to fragmented control of activities in the watershed. To attack these problems, the following areas for further study include (1) alternative methods of weed control; (2) a study of Lake Noquebay's sediments to determine their role in the nutrition of the mulfoil; (3) an evaluation of legal and political procedures for maintaining water quality and controlling recreational activities; and (4) an evaluation of programs to assist the tourist industry. (Richard-Wisconsin)
W72-03993

WATER RESOURCES AS SOCIAL PROBLEMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Sociology.
J. A. Ballweg, and C. A. Ibsen.
Water Resources Bulletin, Vol 7, No 5, October 1971, p 935-940. 14 ref. OWRR A-029-VA (3).

Descriptors: Water resources, *Social aspects, *Motivation, *Behavioral aspects, Leadership, Water pollution, Attitudes, Decision making, Planning, Ohio, Virginia.
Identifiers: *Social problems, *Public concern, *Motivational aspects, Perceptions.

Evidence from 1969 studies in Virginia and Ohio suggests that neither community leaders nor the general public are likely to define water related problems as major problem areas. An examination

of the components of a social problem tends to indicate that water problems have not moved beyond a level of minimal public concern. When respondents were willing to describe existing or potential water problems, perceptions as well as possible solutions were described in abstract rather than action-oriented terms. It is suggested that efforts to eliminate water resource problems are not likely to be effective until public concern moves to motivational and behavioral levels. (Strachan-Chicago)
W72-03994

URBAN WATER: MULTIPLE-USE CONCEPTS,
Colorado Univ., Boulder. Center for Urban Engineering Studies.
Ernest J. Flack.
Journal of the American Water Works Association, Vol 63, No 10, October 1971, p 644-646, 5 ref.

Descriptors: *Water utilization, Efficiencies, *Competing uses, Evaporation control, Evapotranspiration control, Recirculated water, Use rates, Water policy, Water demand, Water allocation, Water rights, *Municipal water.
Identifiers: *Multiple use concepts.

Traditional water use concepts have been single purpose only. Urban water managers have sought to supply a single quality of water to all uses at the least possible cost. However, dwindling freshwater supplies, and ever increasing industrial and municipal water needs have dictated a change in policy. New management concepts are needed to permit the transition to multiple use of the water supplies of the urban communities. Present methods of water needs projection assume: (1) technological changes will not occur; (2) water demand is inelastic; (3) present inefficiencies of use will continue; and (4) industrial use will expand in proportion to population. Multiple use analysis recognizes that treated effluent may provide a cheaper source of water in the future for many areas. Inefficiencies of use will be eliminated if water costs continue to rise. Therefore, the new management concepts must start on an areawide basis and analyze all waters, natural or recycled, contained within that area as possible sources of municipal supply with or without treatment, and to obtain the necessary equipment, technological know-how, and in some cases, legislative approval to develop these sources. (Lowry-Texas)
W72-04073

WATER RESOURCES POLICY IN WISCONSIN: GENERAL SUPPORTING STUDIES, VOLUME II,
Wisconsin Univ., Madison. Dept. of Civil Engineering; and Wisconsin Univ., Madison. Dept. of Industrial Engineering.
A. H. J. Dorcey, R. S. Howe, E. F. Joeres, and L. F. Wible.
Available from the National Technical Information Service as PB-206 220, $3.00 in paper copy, $0.95 in microfiche. Wisconsin Water Resources Center, Madison, Partial Completion Report, 1971. 275 p, 13 fig, 35 tab, 83 ref, 6 append. OWRR B-038-WIS (2).

Descriptors: *Water quality, *Economic efficiency, *Cost-benefit analysis, *Water policy, *Administration, *Waste treatment, Wisconsin, *Cost sharing.
Identifiers: *Phosphate removal, *Effluent charge, *User charges, *Optimal tax, Policy mechanism, Assessment, *Institutional design, Cost minimization models, Southeastern Wisconsin, Lower Fox River, Lake Michigan drainage basin.

Policy design must be placed in the broader context of institutional design. Present fiscal policies are not economic incentives; but rather, they result in substantial subsidies to the waste producer. Assessment of a uniform secondary-treatment policy indicates that general application of the policy for treatment of municipal wastes can result in highly inefficient use of funds for water quality improvement, and can result in large investments in treatment facilities without corresponding increases in water quality. A review of the procedure for establishing desirable water quality levels in Wisconsin leads to the conclusion that there are substantial opportunities for strengthening and improving the process to achieve more effective public participation and thus arrive at decisions that reflect more accurately the wishes of society. A recent state policy requiring a uniform phosphate removal of 85 percent from all point sources of 2,500 or more population in the Lake Michigan drainage basin is examined in light of an economic efficiency objective. Cost savings of the least-cost solution versus the state uniform treatment requirement are of the order of $.6 million per year at 85 percent removal, and $.75 million per year at 80 percent removal. (see also W72-01979, W72-04078 thru W72-04080) (Kuelz-Wisconsin)
W72-04077

WATER RESOURCES POLICY IN WISCONSIN: PROBLEMS OF A METROPOLITAN REGION, VOLUME III,
Wisconsin Univ., Madison. Dept. of Urban and Regional Planning; and Wisconsin Univ., Madison. Dept. of Agricultural Economics.
P. B. Ashelman, E. L. David, J. M. Eisen, M. D. Copely, and I. K. Fox.
Available from the National Technical Information Service as PB-206 221, $6.00 in paper copy, $0.95 in microfiche. Wisconsin Water Resources Center, Madison, Partial Completion Report, 1971. 320 p, 14 fig, 48 tab, 162 ref, 4 append. OWRR B-038-WIS (4).

Descriptors: *Water policy, *Administration, *Cities, *Municipal wastes, Economics, *Financing, *Water management (Applied), *Legal aspects, *Political aspects, Municipal water, Industrial water, Waste treatment, Septic tanks, Well regulations, Flood control, Federal government, Local governments, Flood plains, Wisconsin.
Identifiers: *Regional planning, *National policy, *User charges, One treatment plant, '701' planning, Southeastern Wisconsin, Fox River (Ill).

These studies provide insight into problems of water resources management in a metropolitan region in Wisconsin, as a basis for assessing their implication for national policy. Researchers found that present wastewater treatment plants were constructed on an uncoordinated, individual basis with a lack of consideration for water-quality levels. Analysis of recent population, economic, and land-use trends produced the following observation: planning growth on a regional basis could alleviate the problems of greater burden on small streams and taxing capacity of sewage treatment and municipal water systems. A study of '701' planning found that federal funds for regional and state-wide 'comprehensive' planning fulfill an urgent need in the institutional structure and emphasized '701' funds do not prevent any regionwide planning. A case study of Brookfield, Wisconsin, emphasizes the conflict between local and regional policies on sewage treatment and concludes that establishment of an intraregional institutional arrangement would be necessary to assign decision-making power to representatives of those affected. Evaluation of present methods of financing sewerage systems suggests sewerage service charges and user charges as alternative methods of funding. (See also W72-01979, W72-04077 thru W72-04080) (Kuelz-Wisconsin)
W72-04078

PROBLEMS AND ISSUES OF IMPLEMENTING THE FEDERAL WATER PROJECT RECREATION ACT (PL 89-72) IN THE PACIFIC NORTHWEST (PHASE I),
Oregon State Univ., Corvallis. Water Resources Research Inst.
For primary bibliographic entry see Field 06E.
W72-04095

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

SOME LONG RUN EFFECTS OF WATER-PRICING POLICIES,
Nebraska Univ., Lincoln. Dept. of Civil Engineering.
M. Gysi, and D. P. Loucks.
Water Resources Research, Vol 7, No 6, p 1371-1382, December 1971. 4 fig, 12 ref.

Descriptors: *Pricing, *Optimum development plans, *Future planning (Projected), *Benefit cost analysis, Water supply, Dynamic programming, Estimating, Social impact, Mathematical models.
Identifiers: Block rate, Constant rate schedules, Summer differential rate.

An attempt is made to extend the work recently reported by Riordan on the application of a general dynamic programming model to the problem of estimating an optimal capacity expansion schedule for an urban water supply system. The main intent of this article is to propose a methodology for estimating the effects of various pricing and social policies on the community of water users. Various water-pricing policies are discussed, e.g. declining block rate or promotional pricing, constant rate (per unit) schedules, flat rate of fixed monthly charge, summer differential rate, and incremental block pricing. A forward moving dynamic programming algorithm is used to estimate the size and timing of water supply capacity increases that would maximize the present value of community net benefits. The objective of maximizing the present value of future marginal consumer surpluses plus producer revenues, minus production costs and capacity costs for a given pricing policy was achieved. The model results showed that a combination of summer differential plus increasing block rate structure appeared to offer the greatest net benefits to the system. (Ligon-Cornell)
W72-03682

QUANTITATIVE WATER RESOURCE BASIN PLANING: AN ANALYSIS OF THE PECOS RIVER BASIN, NEW MEXICO,
New Mexico Univ., Albuquerque. Dept. of Economics.
For primary bibliographic entry see Field 06B.
W72-03767

INORGANIC CHEMICALS INDUSTRY PROFILE.
Datagraphics, Inc., Pittsburgh, Pa.
For primary bibliographic entry see Field 05G.
W72-04099

6D. Water Demand

THE VALUE OF WATER USED IN WASHINGTON'S IRRIGATED AGRICULTURE,
Washington State Water Research Center, Pullman.
K. Whittlesey, and H. Allison, Jr.
Available from the National Technical Information Service as PB-206 128, $3.00 in paper copy, $0.95 in microfiche. Washington Agricultural Experiment Station Bulletin 745, November 1971. Completion Report, n. a., 20 p, 24 tab, 7 fig, 44 ref. OWRR A-025-WASH (2).

Descriptors: *Water values, *Linear programming, Efficiencies, Washington, *Irrigation, Irrigation efficiency, Water demand, Agricultural engineering, Productivity, Water utilization.

Ninety percent of the present water use in Washington State is in agriculture. With large quantities of irrigable lands yet nonirrigated, agriculture represents a large potential claim on the existing water resources. If additional water is to be used for irrigated agriculture, it must be

shown that Washington's agriculture will provide economic returns greater than alternative uses of water. The major objective of this study was to determine the effects of specific economic and physical phenomenon on the value of irrigation water. Linear programming was selected as the method for estimating the value of water in this study. The situation modeled was a typical 200 acre general crop farm in the Columbia Basin Project of Central Washington. The marginal value functions of water derived from this analysis may be interpreted as the demand function for water at the farm level. At the 75 percent efficiency level of water use the marginal value of water ranged as high as $4.02 per acre inch when wheat, alfalfa, beans and sweet corn were in the crop rotation. Water used in potato production with a 50 percent efficiency had marginal values ranging up to $28.89 per acre inch. (See also W72-03538)
W72-03537

THE VALUE OF WATER USED IN WASHINGTON'S IRRIGATED AGRICULTURE,
Washington State Water Research Center, Pullman.
K. Whittlesey, and H. Allison, Jr.
Completion Report, n.d., 75 p, 24 tab, 7 fig, 44 ref. OWRR A-025-WASH (1).

Descriptors: *Water values, *Linear programming, Efficiencies, Washington, *Irrigation, Irrigation efficiency, Water demand, Agricultural engineering, Productivity, Water utilization.

(See also W72-03537)
W72-03538

SOME LONG RUN EFFECTS OF WATER-PRICING POLICIES,
Nebraska Univ., Lincoln. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06C.
W72-03682

AN EXPERIENCE IN PLANNING: THE SYSTEMS APPROACH,
Corps of Engineers, New York. North Atlantic Div.
For primary bibliographic entry see Field 06A.
W72-03684

GROUND WATER FOR PLANNING IN NORTHWEST OHIO, A STUDY OF THE CARBONATE ROCK AQUIFERS.
Ohio Dept. of Natural Resources, Columbus. Div. of Water.

1970. 123 P, 73 FIG, 10 TAB, 30 REF.

Descriptors: *Aquifers, *Carbonate rocks, *Water supply, *Planning, *Groundwater, *Ohio, Groundwater basins, Aquifer characteristics, Hydrogeology, Groundwater mining, Water quality, Hydrogen sulfide, Hardness (Water), Limestone, Dolomite, Irrigation wells, Regional analysis.
Identifiers: *Carbonate rock aquifers.

The Northwest Ohio Water Development Plan, prepared by the Ohio Water Commission (1967), recommended a drilling and testing program to evaluate the quantity and quality of the ground water available in the Northwest Ohio area. Seventy-six large diameter limestone and dolomite wells were drilled, tested, and analyzed as the basis for this two and one-half year study. The limestone-dolomite aquifer in northwest Ohio currently yields 32.69 million gallons per day to municipal and industrial wells. Large additional quantities are pumped for irrigation and domestic supplies. Estimates of well-field capacities in various undeveloped areas have been included in this report as a guide for potential development. The quality of the ground water is equally as important as quantity in planning for future use. Softening is recommended for ground-water supplies throughout the study area. Hydrogen sulfide is often present in varying amounts. However, in nearly all instances, objectionable concentrations of hydrogen sulfide can be removed by simple and inexpensive processes. Ground-water development in some portions of the area would be restricted by quality considerations, with present treatment methods. Even considering the quality limitations, the potential of the carbonate aquifer in northwest Ohio far exceeds the present groundwater development. (Poertner)
W72-03975

THE NORTHWEST OHIO WATER DEVELOPMENT PLAN.
Burgess and Niple Ltd., Columbus, Ohio.

Ohio Water Commission, Department of Natural Resources, Columbus, January, 1967. 318 p, 64 fig, 111 tab.

Descriptors: *Planning, *Water resources development, *Administration, *Ohio, Water supply, Water quality, Industrial water, Agriculture, Human population, Recreation, Streamflow, Flood control, Underground storage, Water Quality Act, Finance, Groundwater, Reservoirs, Lake Erie, Pipelines, Water pollution abatement.

The Northwest Ohio Water Development Plan provides a comprehensive plan for the development of water resources that will give maximum support to the growth and development of the region and the State. In addition, it presents programs for the total management of water so that optimum economic and social benefits may be realized. A comprehensive and balanced plan for all phases of water management are provided by the study including: public, industrial, and agricultural water supply; stream water quality control; stream flow improvements; recreational needs; and flood control. Two estimates of future water needs for each city and village having a public water supply, and for industry, are presented. One is based on a projection of historic growth rates, and the other is based on an accelerated growth rate that could occur if water is not limiting in quantity or quality. The recommended water plan is based on the accelerated growth that would be sustained by the fully developed economic potential of the region. The public water supply portion of the plan has been limited to the delivery of raw water to existing or future water treatment plants. Expandable capacities of existing public water supplies are shown. Supplies from stream flow, upground or onstream storage, underground sources, and pipelines from Lake Erie are presented as alternate possibilities to the recommended plan. Pollution abatement phases of the plan are designed to meet stream water quality standards in accordance with the Federal Water Quality Act of 1965. Financing methods and recommendations for administration are also discussed. (Poertner)
W72-03976

WATER AND SAN DIEGO COUNTY GROWTH.
Western Management Consultants, Inc., San Diego, Calif.

San Diego County Water Authority, San Diego, California, 1966. 92 p, 21 fig, 12 tab.

Descriptors: *Water requirements, *Water utilization, *Water resources development, *Aqueducts, *California, *Planning, Population, Assessments, Industrial water, Agriculture, Water sources, Water storage, Water supply, Financing, Taxes, Tax rate, Colorado River.
Identifiers: *San Diego County, *San Diego County Water Authority, *Metropolitan Water District of Southern California.

The development is examined of the system used to distribute imported water to San Diego County and other water short areas of Southern California. San Diego has been capable of absorbing nearly a three-times increase in population since 1946-47, and of providing more than 260,000 acre-feet of water required annually by this population. More than 80 percent of this water is imported from the Colorado River via the aqueducts of the Metropolitan Water District of Southern California and The San Diego County Water Authority. Conservative estimates of future population growth indicate that the County will contain 2 million persons at some point between 1980 and 1990. The water requirements of such a population are calculated on a per capita basis since the proportion of water used for commercial and industrial purposes in San Diego is small in comparison with the volume used for household purposes. The annual demand for water in San Diego County is projected to exceed 400,000 acre feet by 1990. Plans are already underway for increasing the capacity of the San Diego County Water Authority aqueduct system to 591,000 acre feet per year, or more, by the 1980's. This increase in capacity will be financed by the issuance of bonds which were approved by the voters of San Diego County, and will be accomplished by the addition of a second pipeline to the second aqueduct. (Poertner)
W72-03979

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PACIFIC POWER & LIGHT COMPANY

OUACHITA RIVER BASIN IN ARKANSAS,
Arkansas Soil and Water Conservation Commission, Little Rock.
For primary bibliographic entry see Field 04B.
W72-03980

6E. Water Law and Institutions

ECONOMIC AND ORGANIZATIONAL ISSUES IN ALASKA WATER QUALITY MANAGEMENT,
Alaska Univ., Fairbanks. Inst. of Water Resources. Alaska Univ., Fairbanks. Inst. of Social, Economic and Government Research.
For primary bibliographic entry see Field 05G.
W72-03260

WATER QUALITY STANDARDS AND POLLUTION ABATEMENT EFFORTS OF NEW YORK AND VERMONT.
Federal Water Pollution Control Administration, Washington, D.C.
For primary bibliographic entry see Field 05G.
W72-03517

LAKE BASIN CHARACTERISTICS AND NATURE AND EXTENT OF THE POLLUTION PROBLEM.
Federal Water Pollution Control Administration, Washington, D.C.
For primary bibliographic entry see Field 05G.
W72-03518

CONFERENCE PURPOSE, AUTHORITY, AND RECOMMENDATIONS.
Federal Water Pollution Control Administration, Washington, D.C.
For primary bibliographic entry see Field 05G.
W72-03519

SOCIAL AND INSTITUTIONAL OBSTACLES TO AGRICULTURAL DEVELOPMENT OF ARID LANDS IN THE MIDDLE EAST,
Resources for the Future, Washington, D.C. Land Use and Management Program.
For primary bibliographic entry see Field 03F.
W72-03653

ARID LANDS AGRICULTURE AND THE INDIANS OF THE AMERICAN SOUTHWEST,
Arizona Univ., Tucson. Office of International Programs; and Arizona Univ., Tucson. Dept. of Anthropology.
For primary bibliographic entry see Field 03F.

W72-03655

INTERNATIONAL TRAINING: THE INTERAMERICAN CENTER FOR LAND AND WATER RESOURCE DEVELOPMENT: A CASE STUDY,
Utah State Univ., Logan. International Programs and Studies.
For primary bibliographic entry see Field 03F.
W72-03658

EFFECTIVENESS OF FOREIGN AID-THE CASE OF SOMALIA,
Windsor Univ. (Ontario). Dept. of Economics.
O. Mehmet.
Journal of Modern African Studies, Vol 9, No 1, p 31-47, 1971. 4 tab, 14 ref.

Descriptors: *Arid lands, *Foreign lands, *Water resources development, Economic feasibility, Financial feasibility, Political aspects, Planning.
Identifiers: *Somalia, *Developing countries, *International aid.

The arid nation of Somalia is one of the poorest nations in the world, with an estimated annual per capita income of 50 dollars. However, it is one of the world's largest recipients of foreign aid, receiving an annual average of 15 dollars/per capita in 1965-1969, which was more than 3 times the average annual aid to other developing countries during the same period. Transportation, agriculture and industrial development received the largest allocations, while education and water supplies received surprisingly small allocations. Drought, resulting in reduced grain production and heavy livestock losses, combined with border incidents with Ethiopia and the eventual takeover by a military dictatorship, tended to retard development. While foreign aid came from many sources and was designated for many different developmental projects, all indications are that it was not for completely altruistic purposes. Much of it reflects cold-war rivalry and the strategic importance of Somalia dominating the entrance into the Red Sea and facing the Indian Ocean. American aid was mostly for deep water ports and construction of electricity and water supplies. In most cases, funds for aid came tied to unfavorable financial conditions, and with the inability of the country to develop fast enough, such aid will burden the country with almost impossible debtservicing obligations. (Casey-Arizona)
W72-03696

HOPI COLONIZATION ON THE COLORADO RIVER,
San Fernando Valley State Coll., Northridge, Calif.
For primary bibliographic entry see Field 03F.
W72-03708

POLLUTION CONTROL AND THE PLATING INDUSTRY,
For primary bibliographic entry see Field 05D.
W72-03728

GROUNDWATER POLLUTION IN RHODE ISLAND: A STUDY OF LAW AND ADMINISTRATION,
Rhode Island Univ., Kingston. Water Resources Center.
D. B. Burke, Jr..
Available from National Technical Information Service as PB-206 299. Summery Completion Report, n.d., 33 p, 36 ref. OWRR A-032-RI (3).

Descriptors: *Water law, *Groundwater, Water pollution, *Rhode Island, Judicial decisions, Legislation, *Water pollution control, Legal aspects, Administration.

The purpose was to ascertain the legal theories under which pollution of groundwater is policed in Rhode Island. A study of that law indicated that the underlying legal theory is uncertain, so the author went on to suggest his own view of the situation--and to suggest a legal theory which would preserve the quality of the state's groundwater resources. The enforcement of present laws relating to such pollution was also studied in the field and through state records. The enforcement process was found ad hoc and not concerned with the upgrading and preservation of water quality. Water quality data is assembled, but little use is made of it by state officials. To improve this situation, the law in this area must move beyond the concept of public health laws, toward a notion of water law that balances many possible uses for our water supply and recognizes the existance of hydro-ecology in a watershed. (See also W71-11863)
W72-03761

A SURVEY OF NEW HAMPSHIRE WATER LAW, III: THE REVISED STATUTES ANNOTATED,
New Hampshire Univ., Durham. Dept. of Economics.
R. H. Forste, and A. J. Kalinski.
New Hampshire Water Resources Research Center, Durham, Bulletin 4, Feb 1971. 185 p. OWRR A-011-NH (5).

Descriptors: Conjunctive use, *Water rights, Water utilization, Judicial decisions, *New Hampshire, *Legal aspects, *Riparian rights.
Identifiers: Legal review, Administrative structures, *Statutes.

Over 750 statutes which relate directly and indirectly to waters and water use in the State of New Hampshire were compiled and annotated from the New Hampshire Revised Statutes Annotated. The Statutes were classified and presented in eight major categories: (1) Waters as boundaries; (2) Regulatory and developmental authorities for water resources; (3) Water quality and disposal of wastes; (4) Water supply systems; (5) Access to recreational waters; (6) Waterbased recreational activities; (7) Miscellaneous commercial water uses; (8) Taxation of water-related activities and structures. The compilation is intended for use by planners, lawyers, citizens and legislators in dealing with water resource problems, determining necessary additional legislation and deleting outdated and inconsistent statutes. The statutes are current through the 1970 special session of the New Hampshire Legislature. (See also W71-03805)
W72-03765

COMMUNITY WATER PROBLEMS AS A FACTOR IN MUNICIPAL INCORPORATION IN MONTANA,
Montana State Univ., Bozeman. Water Resources Research Center.
Ellis Waldron.
Available from the National Technical Information Service as PB-206 138, $3.00 in paper copy, $0.95 in microfiche. Completion Report, n.d. 12 p. OWRR A-024-MONT (2).

Descriptors: *Community development, *Political aspects, *Institutions, *Water resources development, *Municipal water, *Montana.
Identifiers: Great Falls (Mont), Billings (Mont), Missoula (Mont).

The primary thrust of this study has been to determine how local water problems and the need for community water supplies have been linked with municipal organization in Montana. A related question has been to examine the relationship of the rural special improvement district system and the state Water Resources Board to the organization of small unincorporated communities in order that they might acquire local water systems. Finally, a case study involving the three largest Montana communities -- Great Falls, Billings and Missoula -- was conducted to ascertain how utility extension policies have been related to their urban growth.

W72-03766

ENVIRONMENTAL PROGRAMS OF THE FUTURE,
Environmental Protection Agency, Washington, D.C.
For primary bibliographic entry see Field 05G.
W72-03933

PROFESSIONAL STYLES IN GOVERNMENT: TOUCHSTONES FOR THE NEW POLICY SCIENTIST,
Brown Univ., Providence, Rhode Island. Dept. of Political Science.
E. C. Hargrove.
Policy Sciences, Vol 2, p 229-247, 1971. 11 tab, 16 ref, 1 append.

Descriptors: *Governments, *Administration, *Decision making, Planning, Management, Education, Water policy, Social values, Attitudes.
Identifiers: *Policy, *Policymaking, *Policy analysts, Professional style.

New kinds of policy analysts and policy scientists are being trained in university graduate programs but the outlines of this new profession remain fuzzy. A comparative analysis of other professionals in government advisory roles may provide touchstones by which to develop the new profession. Urban planners, lawyers, economists and political scientists were interviewed about their experience in government. Propositions are developed about characteristic modes of thought and problem-solving styles of each profession and conclusions drawn about the relative 'effectiveness' of each set of professional skills in a policymaking process. It is then suggested that the new policy scientist profession should develop some of the positive skills of the other fields in order to enhance effectiveness. (Davis-Chicago)
W72-03937

POLITICAL RATIONALITY RECONSIDERED: NOTES ON AN INTEGRATED EVALUATIVE SCHEME FOR POLICY CHOICES,
Konstanz Univ. (West Germany).
R-R. Grauhan, and W. Strubelt.
Policy Sciences, Vol 2, p 249-270, 1971. 100 ref.

Descriptors: *Decision making, *Political aspects, *Evaluation, *Political constraints, Social aspects, Attitudes, Planning, Administration, Governments, Priorities.
Identifiers: *Policymaking, *Poritical rationality, *Policy, Political choice, Goals, Policy choices.

The concept and problem of political rationality is discussed. The concept that the absence of presence of rationality manifests itself in choice situations is applied to an explanation of the specific characteristics of political choice. Criteria for rationality, considering process, goal contents and structure criteria and the restrictions for rationality, analytically inherent in any choice structure are discussed. Difference between these analytical (i.e. principally unremovable) restrictions and the (principally removable) 'confining conditions' for rational political choices provided by the circumstances of present-day politics is explained. (David-Chicago)
W72-03938

PUBLIC OPINION AND ENVIRONMENTAL QUALITY: A REAPPRAISAL,
Simon Fraser Univ., Burnaby (British Columbia).
Timothy O'Riordan.
Environment and Behavior, Vol 2, No 3, p 191-214, June 1971. 3 fig, 6 tab, 49 ref.

Descriptors: *Political aspects, *Environment, *Decision making, *Social aspects, Political constraints, Resource development, Model studies, Psychological effects, Environmental effects.
Identifiers: *Resource management, *Public opinion, *Environmental quality, Advocacy groups, Opinion research.

The emergence of various kinds of advocacy groups demanding higher standards of environmental quality is now widespread. In many cases the activities of such groups are of such political potency that the traditional dominance of the professional expert in resource management decisions is being threatened. The role of such groups is identified in a generalized decision making model. The difficulties and dangers involved when trying to canvass public opinion in such matters are pointed out. A plea is made for more sophisticated small group analysis, the results from which would help to assess better the nature and role of public opinion with regard to environmental quality issues. (Davis-Chicago)
W72-03946

URBAN STUDIES AND ACTION RESEARCH,
Northwestern Univ., Evanston, Ill.
For primary bibliographic entry see Field 06B.
W72-03949

VARIATIONS IN BEHAVIOR OF PLANNING AGENCIES,
Rutgers-The State Univ., New Brunswick, N.J. Dept. of Urban Planning and Policy Development.
D. A. Krueckeberg.
Administrative Science Quarterly, Vol 16, No 2, p 192-202, June 1971. 2 fig, 6 tab, 30 ref.

Descriptors: *Planning, *Decision making, *Model systems, *Behavior, *Environment, *Organizations, Dimensions, Input-output analysis, Analysis, City planning.
Identifiers: *Planning agencies, *Variations, *Empirical model, Factor analysis.

An empirical model of metropolitan planning agencies is presented to study variations in planning behavior. It is assumed that variations in organizational behavior patterns constitute responses to variations in the environment of the organization. Study of these variations explains the restraints on rational action. The analysis addresses itself to three specific questions. (1) What are the principal dimensions of planning. (2) What are the modal types of agency behavior. (3) How are typal variations in output related to variations in input and environment. Factor analysis is employed to define the dimensions of agency input and output. These dimensions are further used to cluster the agencies into input and output types. Study of the linkages between input and output types yields a model of affinities of types. Underdeveloped and developing agencies are found to constitute significant styles of agency behavior that are not explained by current planning theory. (Strachan-Chicago)
W72-03950

COMMUNITY WATER PROBLEMS AS A FACTOR IN MUNICIPAL INCORPORATION IN MONTANA,
Montana Univ., Missoula.
M. C. Nash.
M. A. Thesis, June 1969. 80 p, 4 tab, 10 ref, 1 append. OWRR A-024-MONT (1).

Descriptors: *Water, *Municipal water, *Water supply, *Community development, Water demand, Water distribution, Organization, Utilities, Planning, *Montana.
Identifiers: *Great Falls, *Billings, *Missoula, *Incorporation, *Water problems, *Water systems, Rural special improvement district system, Water Resources Board.

This study considers how local water problems and the need for community water supplies have been linked with municipal organization in Montana. An examination is presented of the relationship of the rural special improvement district system and the State Water Resources Board to the organization of small unincorporated Montana communities in acquiring local water systems. A case study of the three largest Montana communities - Great Falls, Billings, and Missoula - was conducted to discover how utility extension policies have been related to their urban growth. Additional topics considered are: (1) the evolution of municipal incorporation and water statutes in Montana, and (2) an historical examination of when and why Montana communities have sought to incorporate. (Strachan-Chicago)
W72-03956

AN ANALYSIS OF THE LAW GOVERNING SIX SELECTED WASHINGTON WATER--ORIENTED SPECIAL DISTRICTS, COMMENTARY ON IMPROVING THE FLOOD-ASSOCIATED ACTIVITIES OF THE STATE OF WASHINGTON DEPARTMENT OF WATER RESOURCES,
Washington State Water Research Center, Pullman.
M. D. Garvey, J. D. Morgan, and K. L. Schubert.
June 1970. 373 p.

Descriptors: *Water districts, *Washington, *Water policy, *Administration, *Legislation, *Administrative agencies, Legal aspects, Allotments, Financing, Government finance, Drainage districts, Irrigation districts, Flood control, Flood routing, Dikes, Sewerage.
Identifiers: *Special districts, *Legal organization.

The legal organization of flood control districts were analyzed with the aim of stating, in detail, the existing law with regard to 6 selected special districts. These were: (1) diking, (2) drainage, (3) diking, drainage, and sewerage improvement, (4) flood control, (5) flood control zone and (6) irrigation districts. For purposes of clarity, it was decided to organize the statutory provisions relating to these types of districts into three general categories: (1) establishment, (2) operation and (3) consolidation and dissolution. One major goal of the study was to promote as much as possible the effective revision of the statutes, either by the establishment of a 'super district' encompassing the overlapping functions of the various existing districts or by the enactment of a uniform procedures act. Another major goal of the study was to promote compliance with the existing statutes until such time as revision was accomplished. A new type of district is suggested -- one that would encompass all water management functions under one legal and administrative structure. If overall water management districts cannot be established, legislative action making uniform the various procedures and details of operation of the different types of special districts is a desirable alternative. The methods of initiating the various types of special districts ought to be uniform. There should be a uniform standard for setting the boundaries of all types of districts. Special districts could and should be operated in accordance with uniform standards. The study findings should be useful to persons who distribute flood control funds. (Poertner)
W72-03971

LEGAL ASPECTS OF STORAGE FOR WATER QUALITY IMPROVEMENTS,
Corps of Engineers, Washington, D.C. River and Harbor Board.
For primary bibliographic entry see Field 05G.
W72-04071

WATER RESOURCES POLICY IN WISCONSIN: GENERAL SUPPORTING STUDIES, VOLUME II,
Wisconsin Univ., Madison. Dept. of Civil Engineering; and Wisconsin Univ., Madison. Dept. of Industrial Engineering.
For primary bibliographic entry see Field 06B.
W72-04077

WATER RESOURCES POLICY IN WISCONSIN: PROBLEMS OF A METROPOLITAN REGION, VOLUME III,
Wisconsin Univ., Madison. Dept. of Urban and Regional Planning; and Wisconsin Univ., Madison. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 06B.
W72-04078

WATER RESOURCES POLICY IN WISCONSIN: FLOOD PLAIN MANAGEMENT, VOLUME IV,
Wisconsin Univ., Madison. Inst. for Environmental Studies.
For primary bibliographic entry see Field 06F.
W72-04080

PROBLEMS AND ISSUES OF IMPLEMENTING THE FEDERAL WATER PROJECT RECREATION ACT (PL 89-72) IN THE PACIFIC NORTHWEST (PHASE I),
Oregon State Univ., Corvallis. Water Resources Research Inst.
K. W. Muckleston.
Available from the National Technical Information Service as PB-206 230, $3.00 in paper copy, $0.95 in microfiche. Research Completion Report - Sept. 1, 1971. 62 p, 2 fig, 11 tab, 53 ref, 4 append. OWRR A-005-ORE (1), 14-31-0001-3237.

Descriptors: *Recreation, *Federal government, *Water law, *Project feasibility, Project purposes, Federal project policy, Pacific Northwest U.S., State government, Cost sharing.

Problems and issues of implementing the Federal Water Project Recreation Act (PL 89-72) were isolated and assessed. Can construction agencies be expected to alter their behavior patterns in keeping with the new requirements of PL 89-72. Will the nonfederal entities be given an active voice in planning those functions they agree to cost-share. Will the nonfederal entities develop the expertise necessary to make meaningful inputs in the planning process that the Act now allows them to have. And can and will the nonfederal public bodies finance the large expenditures often required by the Act. In an attempt to answer these questions, questionnaires were designed for federal, state, and local entities participating in the Act. The general categories of information solicited were: the distribution of and the amount spent for cost-sharing under the Act at each project; the identity of the nonfederal participants and their opinions about problems of implementing PL 89-72; information from the Corps of Engineers and Bureau of Reclamation on the significance of recreation and/or fish and wildlife enhancement among the project purposes and in projects' benefit-cost analyses. (Wilson-Oregon)
W72-04095

6F. Nonstructural Alternatives

WATER RESOURCES POLICY IN WISCONSIN: FLOOD PLAIN MANAGEMENT, VOLUME IV,
Wisconsin Univ., Madison. Inst. for Environmental Studies.
J. A. Kusler.
Available from the National Technical Information Service as PB-206 223, $3.00 in paper copy, $0.95 in microfiche. Wisconsin Water Resources Center, Madison, Partial Completion Report, 1971. 278 p, 1 fig, 4 tab, 457 ref, 1 append. OWRR B-038-WIS (5).

Descriptors: *Flood plains, *Flood control, *Land use, *Management, *Public rights, *Zoning, *Land reclamation, *Legal aspects, *Planning, Wisconsin.
Identifiers: *Confiscation, *Environmental corridors, *Constitutionality, Southeastern Wisconsin, Milwaukee (Wisc).

Two basic issues are considered--the advisability and constitutionality of regulations to preserve

flood plain areas as open spaces, and the basic problems in planning and coordination of flood plain management efforts with federal, state, regional, and local elements. The first issue involved legal research of case law across the nation. Investigation of the second issue concerned review of governmental flood plain management efforts in the southeastern Wisconsin area through literature review, telephone surveys, and interviews. An appendix discusses open space regulations and analyzes such regulations in light of specific judicial tests for confiscating and prominent open space zoning cases. A synthesis of tests for distinguishing valid regulations and invalid confiscations is attempted and the analysis suggests that the key to the constitutionality of 'taking' is in the balance between public objectives and the economic uses of private landowners. Suggestions for approaches to the question of constitutionality noted that precedents for a statutory test for confiscation may be found in the English land-use planning controls and in a Massachusetts statute for preservation of coastal wetlands. (See also W72-01979, W72-04077 thru W72-04079) (Kuelz-Wisconsin)
W72-04080

6G. Ecologic Impact of Water Development

CHARLES RIVER LOCKS AND DAM, BOSTON, MASSACHUSETTS.
Corps of Engineers, Waltham, Mass. New England Div.
For primary bibliographic entry see Field 04A.
W72-03504

ELK CREEK LAKE, ROGUE RIVER BASIN, OREGON.
Army Engineer District, Portland, Oreg. Elk Creek Lake, Rogue River Basin, Oregon.
For primary bibliographic entry see Field 04A.
W72-03505

LOWER BRANCH RUSH RIVER, NORTH DAKOTA.
Army Engineer District, St. Paul, Minn.
For primary bibliographic entry see Field 04A.
W72-03506

NEABSCO CREEK, PRINCE WILLIAM COUNTY, VIRGINIA.
Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 04A.
W72-03507

HILLSDALE LAKE, BIG BULL CREEK, KANSAS.
Army Engineer District, Kansas City, Mo.
For primary bibliographic entry see Field 04A.
W72-03508

LITTLE BLUE RIVER CHANNEL, LITTLE BLUE RIVER, MISSOURI.
Army Engineer District, Kansas City, Mo.
For primary bibliographic entry see Field 04A.
W72-03509

KEHOE LAKE, TYGARTS CREEK, KENTUCKY.
Army Engineer District, Huntington, W. Va.
For primary bibliographic entry see Field 04A.
W72-03510

PHOTOSYNTHETIC PRODUCTION IN A TURBID RESERVOIR,
Kansas State Univ., Manhattan. Water Resources Research Inst.
G. R. Marzolf, and J. A. Osborne.
Available from the National Technical Information Service as PB-206 126, $3.00 in paper copy, $0.95 in microfiche. Completion Report December 1971. 10 p, 1 fig, 15 ref, 4 tab. OWRR A-032-KAN (1).

Descriptors: *Primary productivity, *Reservoir, *Turbidity, Photosynthesis, Limnology, Kansas, Phytoplankton, Runoff, Sedimentation, Watershed.
Identifiers: Tuttle Creek Reservoir (Kan).

Tuttle Creek Reservoir is a 6400 ha reservoir near the eastern edge of the plains phytsiographic province in Kansas. The winds, which are a major climatic feature of the region, and the shallowness of the reservoir (mean depth = 8.0 meters) make thermal stratification rare. Vertical mixing occurs in all seasons. The drainage basin contains soils which contribute a large suspended load to the tributary streams. The reservoir is therefore turbid (light extinction coefficient most often greater than 3.0) with a large horizontal gradient of light availability. Because of the turbidity, primary production may be light limited. The relative magnitude of autochthonous and allochthonous organic material is thus of interest. Shipboard incubation of natural water was used to mimic the vertical profile of photosynthetic carbon assimilation. This allowed the collection of sufficient data over the horizontal expanse of the reservoir to assess the magnitude and variation in energy fixation by the phytoplankton. The mean annual carbon fixation in Tuttle Creek Reservoir is 66.8 mg C/m2 sq./day. The low rate is thought to be a manifestation of a shallow euphotic zone coupled with vertical mixing of photosynthetic cells into and out of this zone with minimal time available for production. (McKenna-Kansas)
W72-03534

SUBLTE ASPECTS OF ECO-SYSTEM MANAGEMENT,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
D. A. Bella.
In: Technology and Management of the Environment, Seminar, Oregon State University, Water Resources Research Institute, p 57-64, July 1971. 1 fig, 9 ref.

Descriptors: *Ecosystems, *Model studies, Research and development, *Theoretical analysis, Aquatic environment.

An attempt is made to discuss some of the less obvious aspects of the general relationships between the biological and non-biological components of aquatic ecosystems which may be significant for the development of satisfactory water resource management policies. When the components of an ecosystem model have been established, they may be arranged in various ways, and the 2 extreme methods of chain and dispersed relationships are discussed. In chain relationships, each of the components is related to only a small number of the total components, and branching in such systems is mainly linear. In dispersed systems, each component is related to a large number of the remaining components. Since a change in 1 of the components will lead to changes throughout the system, it is extremely difficult to date and define relationships within such a complex system. Man-made systems are therefore more susceptible to analysis by established analytical methods. This leads to many types of fallacy when men attempt to define natural systems in terms of their own chain systems. Human chain systems, being simpler, are expanding more rapidly than the ability to forecast their effects on complex dispersed ecosystems. (See also W72-03716) (Casey-Arizona)
W72-03723

LAND USE AND WILDLIFE RESOURCES,
For primary bibliographic entry see Field 04A.
W72-03799

PLANNING AND DEVELOPING THE MULTI--PURPOSE GARRISON DIVERSION UNIT,
Garrison Diversion Conservancy District, N. Dak.
For primary bibliographic entry see Field 04A.
W72-03913

WATER, MAN, AND NATURE,
Bureau of Reclamation, Sacramento, Calif.
For primary bibliographic entry see Field 06B.
W72-03917

ECOLOGY AND THE ESCALATION OF HUMAN IMPACT,
Montreal Univ. (Quebec).
P. Dansereau.
Ekistics, Vol 29, No 189, August 1971, p 158-164. 1 tab, 13 ref.

Descriptors: *Environment, *Management, *Ecology, *Control, Exploitation, Engineering, Design, Planning, Decision making, Cultivation, Industries, Urbanization, Climates.

The language of environmentalists holds certain non-objective terms which insinuate that man 'upsets' the balance of nature. The author maintains that man does not disturb the balance of nature more than any other animal. By applying ecological laws already derived from the study of animals and plants to man, a scale of man's impact upon his environment is presented. A table is presented which indicates the steps in man's control of his environment, and a tentative characterization of their impact. There are five phases of man's management of his environment, and each phase is subdivided into regimes: (1) Primeval/Submission - a. virgin land b. gathering c. hunting and fishing (2) nomadic and pastoral phase: Domestication - d. herding (e) Settlement phase: cultivation - 3. agriculture. (4) Industrial and urban phases: substitution - f. industry g. urbanization. (5) Climatic and cosmic phases: cosmic outburst - h. climate control i. exobiological escape. The four main processes of man's management, exploitation, substitution, engineering, and designing, are reviewed as they represent an increasing consciousness of environment and a developing power to model it and make it fit the ideal image. (Strachan-Chicago)
W72-03932

THE EVERGLADES: WILDERNESS VERSUS RAMPANT LAND DEVELOPMENT IN SOUTH FLORIDA,
Yale Univ., New Haven, Conn. Dept. of Physics.
For primary bibliographic entry see Field 05G.
W72-03955

ENVIRONMENTAL GUIDELINES FOR ROAD CONSTRUCTION IN ALASKA,
Environmental Protection Agency, College, Alaska, Alaska Water Laboratory.
For primary bibliographic entry see Field 04C.
W72-03984

07. RESOURCES DATA

7A. Network Design

SPACE-TIME SAMPLING OF POLLUTANTS IN AQUIFERS,
Arizona Univ., Tucson. Dept. of Hydrology.
For primary bibliographic entry see Field 05A.
W72-03676

DECISION UNDER UNCERTAINTY APPLIED TO A HYDROLOGIC PROBLEM,
Arizona Univ., Tucson. Dept. of Systems Engineering.
For primary bibliographic entry see Field 06A.
W72-03690

EVALUATION OF WATER QUALITY MONITORING PROGRAMS IN CALIFORNIA.
California State Water Resources Control Board, Sacramento.
For primary bibliographic entry see Field 05A.
W72-03957

AN ENVIRONMENTAL MONITORING PROGRAM FOR THE SACRAMENTO-SAN JOAQUIN DELTA AND SUISUN BAY,
Stanford Research Inst., Menlo Park, Calif.
For primary bibliographic entry see Field 05A.
W72-03959

WEST VIRGINIA WATER QUALITY NETWORK.
West Virginia Dept. of Natural Resources, Charleston. Div. of Water Resources.
For primary bibliographic entry see Field 05A.
W72-03965

7B. Data Acquisition

NUCLEAR TECHNIQUES IN ENVIRONMENTAL POLLUTION.
International Atomic Energy Agency, Vienna (Austria).
For primary bibliographic entry see Field 05A.
W72-03521

A DEVICE FOR SAMPLING IMMEDIATELY ABOVE THE SEDIMENT-WATER INTERFACE,
Georgia Univ., Athens; and Georgia Univ., Sapelo Island Marine Inst.
K. L. Smith, Jr.
Limnology and Oceanography, Vol. 16, No. 4, p 675-677, July 1971. 2 fig, 5 ref.

Descriptors: *Sampling, *Centrifugal pumps, *Bottom sediments, Hoses, Mechanical equipment.
Identifiers: *Bottom water, Benthic sled.

The water column immediately above the sediment surface can be successfully sampled using a device consisting of a bottom sled, a hose, and a centrifugal pump. The device is operated from a floating platform. Water is taken in by the sled nozzle and pulled up through the hose by the pump. Samples are taken from the pump output. Detailed descriptions of the sampler components are given. In use, 15-20 minutes are allowed between submersion of the sled and sampling to allow settling of sediment disturbance. The device can also be used for sampling suspended bottom material. (Mortland-Battelle)
W72-03551

A SIMPLE CORER AND A METHOD FOR SAMPLING THE MUD-WATER INTERFACE,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Centre for Inland Waters.
A. L. W. Kemp, H. A. Savile, C. G. Gray, and A. Mudrochova.
Limnology and Oceanography, Vol. 16, No. 4, p 689-694, July 1971. 5 fig, 1 tab, 3 ref.

Descriptors: *Cores, *Sampling, *Bottom sediments, Benthos, Lakes, Mechanical equipment.
Identifiers: Corer, Bottom water, Sample preservation.

A triple corer, primarily for geochemical investigations, has been designed, based on a modification of the Benthos corer. Satisfactory cores have been taken in clay muds, silty clay muds, silts, and glacio-lacustrine clays at depths up to 250 m. The sediment is extruded layer by layer on a simple screw thread piston device. Results show that extrusion of each tube separately is reproducible and that it is possible to subsample the cores at close intervals. Bottom water for analysis is also collected by the corer. The corer was unsatisfactory in sands, glacial tills, and at locations where a thin layer of mud (about 15 cms) was underlain by stiff glacial tills. It may be used from small or large boats in rough weather conditions if necessary. (Mortland-Battelle)
W72-03558

THE APPLICABILITY OF REMOTE SENSOR TECHNIQUES FOR OIL SLICK DETECTION,
Coast Guard, Washington, D.C. Office of Research and Development.
C. E. Catoe.
Available from the National Technical Information Service as AD-728 422, $3.00 in paper copy, $0.95 in microfiche. February 25, 1971. 24 p, 7 fig, 11 ref. USCG Project 714104/A/009.

Descriptors: *Oil wastes, *Remote sensing, Monitoring, Aerial photography, Infrared radiation, Ultraviolet radiation, Radar, Microwaves, Luminescence, Oil.
Identifiers: Imaging, Optical scanning, Electron beam scanning, Infrared photography, Multispectral photography, Ultraviolet imagery, Radiometry, Detectors, Oil spills.

A wide variety of remote sensing techniques are briefly reviewed and their possible application to detection of oil slicks considered. Research is reviewed and field test results from oil spill overflights are presented. Considering all available information, ultraviolet photographic techniques are considered to offer great potential for detecting oil spills. Other photographic techniques also lend themselves to this area. For example, infrared imagers and multispectral scanners are effective in the ultraviolet and blue spectra and at 8 to 14 micrometers. Radar and passive microwave techniques are also very promising. (Mortland-Battelle)
W72-03561

A LARGE CYLINDRICAL DREDGE,
Akademiya Nauk SSSR, Moscow. Institut Okeanologii.
For primary bibliographic entry see Field 08E.
W72-03564

PHOTOGRAPHING MANGANESE NODULES ON THE OCEAN FLOOR,
Lamont Geological Observatory, Palisades, N.Y.
M. Ewing, D. Horn, L. Sullivan, T. Aitken, and E. Thorndike.
Oceanology International, Vol 6, No 12, p 26-27, 30-32, December 1971. 3 fig.

Descriptors: *Marine geology, *Deposition (Sediments), *Manganese, *Oceanography, *Photogrammetry, Geological surveys, Mapping, Remote sensing, Cameras, Atlantic Ocean, Pacific Ocean, On-site data collections, Methodology, Mineralogy, Chemical precipitation, Sedimentation.
Identifiers: *Marine sediments, Ferromanganese nodules, Ocean floor.

This report is the result of a survey of photographs taken during 28 oceanographic cruises conducted by scientists from Lamont-Doherty Geological Observatory. Data gathered during 17 years of surveying include more than 50,000 photographs taken at about 3,000 camera stations. Methodology of photographing and analyzing the data is described. Maps are included that show distribution of manganese nodules and crusts in the Atlantic and Pacific Oceans, and correlation between nodules and red clay in the deep basins of the north Pacific. The maps also show locations of camera stations and degrees of bottom survey coverage. Nodules appear to be more widely distributed and abundant in the North Pacific than other areas of the Northern Hemisphere. A change in sedimentation from red clay to biogenic ooze occurs at 6 deg 30 min N and is typical of the equatorial Pacific. (Lang-USGS)
W72-03569

COASTAL PROCESSES FROM SPACE PHOTOGRAPHY,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 02J.
W72-03572

OBSERVATION OF SEDIMENT MOTION BY UNDERWATER-TELEVISION,
Research Station for Island and Coast Protection, Norderney (West Germany).
For primary bibliographic entry see Field 02J.
W72-03575

SYNOPTIC OBSERVATIONS OF SAND MOVEMENT,
Army Coastal Engineering Research Center, Washington, D.C.
For primary bibliographic entry see Field 02J.
W72-03582

AN UNDERWATER SURVEY SYSTEM FOR RADIONUCLIDE-TAGGED SEDIMENT TRACING,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 02J.
W72-03583

AN AUTOMATIC ELECTROLYTIC RESPIROMETER-ITS CONSTRUCTION AND USE,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 05D.
W72-03650

APPLICATIONS OF REMOTE SENSING TO ARID-LANDS PROBLEMS,
California Univ., Berkeley. School of Forestry and Conservation.
For primary bibliographic entry see Field 03F.
W72-03659

A SYSTEMS ANALYSIS OF APPLICATIONS OF EARTH ORBITAL SPACE TECHNOLOGY TO SELECTED CASES IN WATER MANAGEMENT AND AGRICULTURE.
Planning Research Corp., Los Angeles, Calif.
For primary bibliographic entry see Field 06A.
W72-03685

A SYSTEMS ANALYSIS OF APPLICATIONS OF EARTH ORBITAL SPACE TECHNOLOGY TO SELECTED CASES IN WATER MANAGEMENT AND AGRICULTURE.
Planning Research Corp., Los Angeles, Calif.
For primary bibliographic entry see Field 06A.
W72-03686

THE FEASIBILITY OF AUGMENTING HYDROLOGIC RECORDS USING TREE-RING DATA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
C. W. Stockton.
Ph. D. Thesis, November 1971. 172 p, 48 fig, 20 tab, 69 ref, 4 append. OWRR A-014-ARIZ (2).

Descriptors: *Hydrologic data, *Dendrochronology, *Time series analysis, *Estimating, *Statistics, Precipitation intensity, Synthetic hydrology, Climatic data, Streamflow.
Identifiers: *Upper San Francisco River, *Bright Angel Creek (Ariz), *Tree-ring indices.

The hypothesis that tree-ring indices contain pertinent information about runoff was tested on two catchments of diverse hydrologic character, Bright Angel Creek and the Upper San Francisco River basins. Multivariate methods were used to assess the similarities and dissimilarities in the complex climate-growth, climate-runoff relationships in these differing precipitation regimes. The

paper related ring-width indices to climate and developed a response function and related runoff to climatic variables to develop a response function. The principal components technique using multiple linear regression was used to develop prediction equations for predicting runoff from ring-width indices. Prediction equations and 214-year synthetic runoff series were developed for both basins. Of the two basins studied, the results from the Upper San Francisco River basin were more satisfactory: 72% to 79% of the annual variance in runoff could be accounted for using prediction equations based on ring-width indices. The synthetic series provided an improved estimate for the mean annual runoff. Further, the series provided information that could be valuable in decision-making processes concerning reservoir design and operation. (Markell-Cornell)
W72-03691

AERIAL COLOR ANALYSES OF WATER QUALITY,
Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
K. R. Piech, and J. E. Walker.
ASCE Proceedings, Journal of the Surveying and Mapping Division, Vol 97, No SU 2, Paper 8507, p 185-197, November 1971. 7 fig, 3 tab, 20 ref, append.

Descriptors: *Aerial photography, *Lakes, *Water quality, Surveys, Water pollution, Instrumentation, Remote sensing.

A new technique utilizing color photography in aerial water analyses uses natural objects in the photographic image to remove peripheral effects in the water quality measurement. The color of a body of water depends upon: (1) source effects, (2) atmospheric effects, (3) surface reflection effects, and (4) volume effects. Volume spectral reflectance is the only definition of water color sensitive to water quality. All other color effects are peripheral effects, and can be described by three parameters. Crucial to the technique is use of shadow information; information traditionally of limited value to the photointerpreter. The technique is applied to measurement of chlorophyll content in Lake Chautauqua in New York State. Reflectances of ground objects are in excellent agreement with the aerial data. (Knapp-USGS)
W72-03861

MONITORING WATER POLLUTION BY REMOTE SENSING,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
J. P. Scherz.
ASCE Proceedings, Journal of the Surveying and Mapping Division, Vol 97, No SU 2, Paper 8550, p 307-320, November 1971. 10 fig, 11 ref.

Descriptors: *Remote sensing, *Monitoring, *Surveys, *Mapping, *Aerial photography, Water pollution, Water quality, Instrumentation, Water pollution sources.

Imaging remote sensing techniques can be effectively utilized as a water pollution monitoring tool if the advantages of imaging remote sensing as applied to other fields are understood as well as how electromagnetic energy reacts with water. The advantages of imaging remote sensing techniques are that: (1) They provide an overall view at one instant of time; (2) they provide a detailed time record which provides means of detecting changes with time; and (3) they can expand the limits of the human eye and sense where the eye cannot see. Short wavelengths of UV and blue energy reflect from the surface without much penetration, while green energy penetrates to a maximum extent, and IR energy is absorbed by only a few inches of water. (Knapp-USGS)
W72-03862

AERIAL PHOTOGRAPHY FOR WATER RESOURCES STUDIES,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
R. W. Kiefer, and J. P. Scherz.
ASCE Proceedings, Journal of the Surveying and Mapping Division, Vol 97, No SU 2, Paper 8545, p 321-333, November 1971. 15 fig, 5 ref.

Descriptors: *Terrain analysis, *Aerial photography, *Remote sensing, *Water resources development, *Surveys, Floods, Lakes, Mapping, Photogrammetry, Water pollution.

The fundamentals of color and color-infrared photography are reviewed. Illustrations are presented to show the use of color and color-infrared aerial photography to study siltation and algae growth in lakes, to map aquatic plants in lakes, to detect and monitor water pollution, and to study stream flooding. (Knapp-USGS)
W72-03863

EVALUATION OF INTEGRATED HYDROLOGIC MONITORING SYSTEM,
Geological Survey, Arlington, Va.
H. R. Feltz, and G. F. Smoot.
In: Advances in Automated Analysis, Vol 2 - Industrial Analysis; Technicon International Congress, November 2-4, 1970, New York, N Y: Therman Associates, Miami, Fla, p 333-340, 1971. 7 fig, 9 ref.

Descriptors: *Chemical analysis, *Water analysis, *Streams, *Telemetry, *District of Columbia, Analytical techniques, Remote sensing, Water quality, Instrumentation, Research and development, Water temperature, Conductivity, Dissolved oxygen, Turbidity, Hydrogen ion concentration.
Identifiers: *Rock Creek (D.C.), *Bubble gage sensor.

A hydrologic test station was installed in July 1968 on Rock Creek, a tributary to the Potomac River in the Washington, D.C. area, with 3 main objectives in mind: to provide a test site for the study and evaluation of equipment; to serve as a demonstration facility for acquainting U.S. Geological Survey personnel and other interested persons with modern techniques of water-quality monitoring; and to gather data about a stream that may be typical of many small drainage basins being absorbed by an expanding population. From the operating experiences during the project, which yielded hourly recordings of selected water-quality parameters over a period of one year, it was concluded that: bubble gage and electronic sensors perform very well; both accuracy and precision of automated wet-chemical field analysis were verified; and the near real-time telemetry of continuous, streamside monitoring of both physical and chemical water quality parameters was proven feasible and reliable. (Woodard-USGS)
W72-03873

AN INSULATED EVAPORIMETER,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
B. P. Van Haveren, and E. E. Farmer.
Water Resources Bulletin, Vol 7, No 6, p 1250-1252, December 1971. 2 ref.

Descriptors: *Evaporation pans, *Instrumentation, Equipment, Air temperature, Solar radiation, Winds, Evaporation.
Identifiers: *Evaporimeters.

A circular evaporation pan, 18 inches in diameter and 8 inches deep was insulated on the sides and bottom using 2 inches of freon-blown polyurethane foam. A U.S. Weather Bureau Class A evaporation pan was used for comparison. Water evaporation from the Class A pan and the insulated pan were highly correlated. Using a water-methanol mixture, the insulated pan may be operated at temperatures below 32 F; the equivalent liquid water evaporation may be determined using a regression equation. (Knapp-USGS)
W72-03878

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 5. HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS, VOLUME 1. HUDSON BAY BASIN.
Geological Survey, Washington, D.C.

Available from GPO, Washington, D C 20402-$2.50 (paper cover). Geological Survey Water-Supply Paper 1913, 1971. 407 p, 1 fig, 1 plate.

Descriptors: *Data collections, *Surface waters, *Streamflow, Stream gages, Lakes, Reservoirs, Stage-discharge relations, Low flow, Peak discharge, River basin.
Identifiers: *Hudson Bay, Surface water records.

One of a series of 37 reports presenting records of stage, discharge, and content of streams, lakes, and reservoirs in the United States during the 1961-65 water years, this report covers the Hudson Bay basin. The data generally comprise a station description and a table showing daily discharge and monthly and yearly discharges. The station description gives the location of the gaging station, drainage area, records available, type and history of gages, average discharge, extremes of discharge, and general remarks. Type of gage currently in use and datum of the gage above mean sea level, and a condensed history of the types, locations, and datums of previous gages used during the record period are listed. Conditions affecting natural flow and information on accuracy of records are noted. Tables give daily, average, and extreme discharges and yearly totals and peak discharges. (Myers-USGS)
W72-03908

AUTOMATED SYSTEM CONTROL,
Monroe County Water Authority, Rochester, N.Y.
C. M. Frenz.
Journal of the American Water Works Association, Vol 63, No 8, p 508-512, Aug 1971. 5 p, 4 fig.

Descriptors: *Computers, *Automatic control, *Control systems, *Water control, Automation, Water distribution (Applied), Water supply systems, Telemetry, Flow charts, Operations.
Identifiers: Computer capability, Computer applications, Computer systems programs, Computer systems hardware, Telemetry systems.

The Monroe County Water Authority serves approximately 300,000 people in 13 towns, 2 villages, and a portion of Rochester, New York. The Authority operates 18 booster pumping stations and 22 elevated tanks and standpipes. In addition, 5 booster pumping stations, 6 tanks and standpipes, and a 50 million gallon reservoir are in the planning stage or under construction. Until 1968, an IBM 1130 computer was used for billing and distribution-network analysis; an increased workload necessitated either expanding the existing computer or obtaining new equipment. An IBM 1800 Data Acquisition and Control System was selected as a replacement because both commercial work and system control could be programed economically. The computer can store 32,000 words, and requires 2 microseconds for memory access. Approximately 1/2 the storage capacity is used for computer operation; the remainder for system control programs. Schematic diagrams of the monitoring and control systems, and a description of the basic operation of the control system are given. (USBR)
W72-03915

TELEMETERING: FIVE UTILITIES' EXPERIENCES,
Santa Cruz Water Dept., Calif.
R. E. Van Loon.
Journal of the American Water Works Association, Vol 63, No 8, p 491-507, Aug 1971. 17 p, 5 fig, 1 plate, 4 photo, 5 tab, disc.

Descriptors: *Automatic control, *Telemetry, *Water supply systems, Digital computers, Control systems, Remote control, Electronic equipment, Utilities, Investment, Cost comparisons, Operating costs, California.
Identifiers: Telecommunication systems, *Telemetry systems, Cost savings.

Representatives of 5 water utilities presented a discussion based on a common theme: Telemetering systems accomplish measurement and control functions more conveniently than manually operated systems. The first part describes a transistorized tone-telemetering system and discusses adaptation of the system to control pressures, water levels, and flow rates throughout the water system. Anticipated problems, interpretation of malfunctions, and corrective methods are discussed. The second part explains the differences between electromechanically controlled and digital computer controlled systems, including costs and versatility. The third part describes the gradual changeover from a manual operation to the remote control and telemetering facilities required for an expanding system. The last 2 parts discuss costs of 2 radically different telemetering systems; operating costs of manually operated vs telemetering control systems are compared. (USBR)
W72-03922

REMOTE DETECTION OF MOISTURE STRESS: FIELD AND LABORATORY EXPERIMENTS,
Iowa State Univ., Ames. Dept. of Agronomy.
R. E. Carlson.
PhD Thesis, 1971. 101 p, 28 fig, 18 tab, 75 ref. OWRR A-031-IA (3).

Descriptors: *Moisture stress, *Plant physiology, *Remote sensing, *Photography, *Leaves, On-site investigations, Laboratory tests, Plants, Spectroscopy, Adsorption, Transmissivity.
Identifiers: *Leaf water content, *Leaf reflectivity.

The relationship between the spectral properties of leaves and the water status of leaves from three crop species was studied under laboratory conditions. The wavelength region examined was from 800 to 2,600 millimicrons. Leaf reflectivity and leaf absorptivity were highly correlated with relative leaf water content. The relationship between leaf transmissivity and relative leaf water content was variable with wavelength. Leaf transmissivity was, however, highly correlated with leaf specific densities. Relative leaf water content was estimated from leaf reflectivity. The estimates were improved if leaf transmissivity was included in the regression equation. In field experiments leaf temperature was significantly affected by relative leaf water content, air temperature, and vapor pressure deficit. The density of both regular color and infrared color film taken directly above the canopy was related to canopy moisture stress. The relationship was highly variable because of film density differences within each slide. It appeared that this source of variability could be reduced if photographs were taken from higher levels. (Woodard-USGS)
W72-04021

WAVE TRAIN DIRECTION ANALYSIS,
Chicago Bridge and Iron Co., Plainfield, Ill. Marine Research and Development.
For primary bibliographic entry see Field 02E.
W72-04023

RESEARCH, DEVELOPMENT, AND PROTOTYPE PRODUCTION OF AN ULTRAVIOLET SENSING SOIL MOISTURE METER,
Geotech, Garland, Tex.
For primary bibliographic entry see Field 02G.
W72-04048

7C. Evaluation, Processing and Publication

PROCESSING AND ANALYSIS OF RADIOISOTOPIC SAND TRACER (RIST) STUDY DATA,
Oak Ridge National Lab., Tenn. Instrumentation and Controls Div.
For primary bibliographic entry see Field 02J.
W2-03584

MODELING OF HYDROLOGIC PROCESSES AND WATER SALVAGE PROCEDURES IN SEMIARID REGIONS,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 02A.
W72-03527

CATALOG OF PESTICIDE NMR SPECTRA,
Environmental Protection Agency, Athens, Ga. Southeast Water Lab.
For primary bibliographic entry see Field 05A.
W72-03541

ANALYSES OF SPECIES DENSITIES BY THE MULTIVARIATE GENERAL LINEAR MODEL,
Smithsonian Institution, Washington, D.C. Museum of Natural History.
M. A. Buzas.
Limnology and Oceanography, Vol. 16, No. 4, p 667-670, July 1971. 2 tab, 6 ref.

Descriptors: *Model studies, *Analytical techniques, *Protozoa, Water temperature, Salinity, Oxygen, Chlorophyll, Maryland, Mathematical models.
Identifiers: *Foraminifera, Linear model, Ammonia beccarii, Eliphidium clavatum, Ammobaculities exiguus, Choptank River (Maryland), Data interpretation, Chlorophyll a.

A multivariate general linear model was developed for use in analyzing observed species densities for three species of Foraminifera at three stations in the Choptank River, Maryland. The model contains 21 parameters for environmental variables (temperature, salinity, oxygen, and chlorophyll a, b, and c), station differences, overall periodicity, and interaction of periodicity and station differences. Several more restricted models were postulated and compared with the general model, but none of these adequately described the data. The high degree of complexity indicates that complex models will be needed to explain observed species densities. (Mortland-Battelle)
W72-03554

ISOPACHOUS MAPPING OF THE LOWER PATUXENT ESTUARY SEDIMENTS BY CONTINUOUS SEISMIC PROFILING TECHNIQUES,
Naval Oceanographic Office, Washington, D.C.
For primary bibliographic entry see Field 02J.
W72-03574

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1966: PARTS 5 AND 6. HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS, AND MISSOURI RIVER BASIN.
Geological Survey, Washington, D.C.

Available from GPO, Washington, D.C., 20402, Price $2.75. Geological Survey Water-Supply Paper 1993, 1971. 666 p, 1 fig.

Descriptors: *Water quality, *Water temperature, *Sediment transport, *Surface waters, Streamflow, Chemical analysis, Data collections, Water analysis, Flow rates, Water chemistry, Sampling, Mineralogy, Metals, Nutrients.
Identifiers: *Hudson Bay basin, *Upper Mississippi River basin, *Missouri River basin.

During the water year ending September 30, 1966, the Geological Survey maintained 203 stations on 120 streams for the study of chemical and physical characteristics of surface water in the Hudson Bay and Upper Mississippi River basins and the Missouri River basin. Samples were collected daily and monthly at 160 of these locations. Samples also were collected less frequently at many other points. Water temperatures were measured continuously at 19 and daily at 79 stations. Quantities of suspended sediment are reported for 43 daily stations. Particle size distributions of sediments were determined at 65 daily and periodic sampling sites. Descriptive statements for each sampling station include location of the station, drainage area, periods of records available, extremes of dissolved solids, hardness, specific conductance, temperature, sediment loads, and other pertinent data. Records of discharge of the streams at or near the sampling station are included in most tables of analyses. (Woodard-USGS)
W72-03608

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 3. OHIO RIVER BASIN-VOLUME 1, OHIO RIVER ABOVE KANAWHA RIVER.
Geological Survey, Washington, D.C.

Available from GPO, Washington, DC 20402 - Price $3.25 (paper cover). Geological Survey Water-Supply Paper 1907, 1971. 621 p, 1 fig, 2 plate.

Descriptors: *Surface waters, *Streamflow, *Hydrologic data, Data collections, *Flow measurement, New York, Pennsylvania, West Virginia, Maryland, Stream gages, Gaging stations, Flow rates, Lakes, Reservoirs, Average flow, Low flow, Peak discharge.
Identifiers: *Ohio River basin.

This volume of surface water data for the Ohio River basin above Kanawha River in the States of New York, Ohio, Pennsylvania, West Virginia, and Maryland is one of a series of 37 reports presenting records of stage, discharge, and content of streams, lakes, and reservoirs in the United States during the 1961-65 water years. The tables of data include a description of the gaging station, and daily, monthly, and yearly discharges of the stream. The description of the station gives the location, drainage area, records available, type and history of gage, average discharge, extremes of discharge, and general remarks. For most gaging stations on lakes and reservoirs a description of the station and a monthly summary table of stage and contents are given. Data for partial-record stations include measurements at low-flow partial record stations and annual maximum stage and discharge at crest-stage stations. (Woodard-USGS)
W72-03609

INTERPRETATION OF ELECTRICAL RESISTIVITY LOGS IN A TWO-ZONE CYLINDRICALLY SYMMETRIC GEOMETRY,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 08A.
W72-03762

CUBIC INTERPOLATION FOR NUMERICAL FLOOD ROUTING,
Turner, Collie and Braden Co., Inc., Houston, Tex.
For primary bibliographic entry see Field 02E.
W72-03843

ROUTING STORM WATER THROUGH A DRAINAGE SYSTEM,
Asian Inst. of Tech., Bangkok (Thailand). Dept. of Hydraulics Engineering.
For primary bibliographic entry see Field 04A.
W72-03847

TWO-DISTRIBUTION METHOD FOR FLOOD FREQUENCY ANALYSIS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 04A.
W72-03848

A NUMERICAL METHOD FOR COMPUTING EQUILIBRIA IN AQUEOUS CHEMICAL SYSTEMS,
California Inst. of Tech., Pasadena. W. M. Keck Labs.
For primary bibliographic entry see Field 02K.
W72-03852

ORTHOPHOTOMAPPING FOR PRUDHOE BAY DEVELOPMENT,
Geological Survey, Anchorage, Alaska. Topographic Div.
T. J. O'Brien.
ASCE Proceedings, Journal of the Surveying and Mapping Division, Vol 97, No SU 2, Paper 8499, p 199-204, November 1971. 2 fig, 3 ref.

Descriptors: *Mapping, *Aerial photography, *Terrain analysis, *Surveys, *Alaska, Instrumentation, Arctic, Oil fields.
Identifiers: *Orthophotomapping.

Orthophotomapping on Alaska's North Slope combines imagery from an aerial photo with some conventional topographic mapping symbols to yield a portrait of the land more complete and realistic than possible by conventional maps. It is particularly suited to the North Slope because significant terrain features such as drained thaw lakes and ice-wedge polygons have no line map symbol. The U.S. Geological Survey is proceeding with a project to prepare 12 orthophotomaps at 1:24,000 scale of a 550 sq mile area at oil-rich Prudhoe Bay. High altitude photography was acquired with flight line planning and photo spacing to give complete coverage of a 1:24,000-scale quadrangle on a single photograph. (Knapp-USGS)
W72-03858

QUAL 1 - SIMULATION OF WATER QUALITY IN STREAMS AND CANALS - PROGRAM DOCUMENTATION AND USERS MANUAL.
Texas Water Development Board, Austin. Systems Engineering Div.
For primary bibliographic entry see Field 05B.
W72-03880

FLOOD OF MARCH 1968 ON THE CHARLES RIVER, MASSACHUSETTS,
Geological Survey, Washington, D.C.
L. A. Swallow, R. G. Petersen, and G. H. Searles.
Available from U.S. Geological Survey, Washington, DC 20242-$1.25 per set. Geological Survey Hydrologic Investigations Atlas HA-419, 2 sheets, 1971. Text, 4 fig, 2 photo, 2 tab, 4 ref.

Descriptors: *Floods, *Flood damage, *Flood plains, *Massachusetts, *Urbanization, Flood control, Peak discharge, Flow rates, Regional flood, Streamflow, Hydrologic data, Hydrographs, Flood forecasting, Cities.
Identifiers: *Charles River (Mass), *Urban hydrology, Hydrologic atlas.

This two-sheet hydrologic atlas presents six photomosaics which show areas inundated along the Charles River during the flood of March 1968. Flood data for the gaging stations in the basin illustrate the magnitude of the 1968 flood and should assist State and local planners in making decisions pertaining to flood-plain zoning and flood prevention. The flood of March 1968 on the Charles River was caused by an intense 3-day storm, which began on March 17. The rain, totaling from 5 to 6 inches in 36 hours, fell on ground already saturated by snowmelt and 1 1/2 to 2 inches of precipitation on March 12-13. It caused a flood that equaled or exceeded the maximum for the period of record at the three gaging stations on the Charles River. The peak discharge for the Charles River at Charles River Village was 3,220 cfs for March 21-22, 1968. Flood losses of all types--residential, industrial, commercial, and public were estimated to be more than $600,000. (Woodard-USGS)
W72-03903

FLOODS ON ROCK RIVER IN SOUTHWESTERN JEFFERSON COUNTY, WISCONSIN,
Geological Survey, Washington, D.C.
J. O. Shearman, and B. K. Holmstrom.
Available from U.S. Geological Survey, Washington, DC. 20242--75 cents. Geological Survey Hydrologic Investigations Atlas HA-413, 1 sheet, 1971. 8 fig, 1 map, 2 photo, 3 tab, 6 ref.

Descriptors: *Floods, *Flood damage, *Streamflow, *Flood forecasting, *Wisconsin, Regional flood, Flood control, Flow rates, Peak discharge.
Identifiers: *Rock River (Wis), Jefferson County (Wis), Standard Project Flood, Intermediate Regional Flood.

This hydrologic atlas shows computed water-surface elevations; defines the areal limits of flood inundation for the regional flood; and discusses briefly the depths, durations, and velocities of floodwaters along Rock River in Jefferson County, Wisconsin. The drainage area for Rock River is 2,240 square miles at the inlet of Lake Koshkonong. The 5-year flood at Afton has a peak discharge of 9,700 cfs as determined by the frequency analysis. In a 9-year period, 1915-23, this flow was equaled or exceeded four times. In a 10-year period, 1930-39, the annual-flood peaks did not reach this magnitude. However, for the 53-year period of record, 1914-66, the 5-year flood has been equaled or exceeded 10 times. This is close to the expected long-term average of once in 5 years. The regional flood would affect numerous manmade structures within the study reach. Lower bridge members at seven of the ten bridge crossings would be submerged. Also, approach grades at the State Highway 106 bridge east of Ft. Atkinson and at the State Highway 26 and 89 bridge in Jefferson would be inundated by the regional flood. Except for Highway 106, where about 1,500 cfs would flow across the east approach grade, there would not be significant approach-grade overflow. (Woodard-USGS)
W72-03904

HYDROGEOLOGY OF THE PINE RIDGE INDIAN RESERVATION,
Geological Survey, Washington, D.C.
M. J. Ellis, and D. G. Adolphson.
Available from US Geological Survey, Washington, DC 20242 - $1.25 per set. Geological Survey Hydrologic Investigations Atlas HA-357, 2 sheets, 1971. Text, 5 map, 3 tab, 8 ref.

Descriptors: *Water resources development, *Groundwater, *Surface waters, *Indian reservations, *South Dakota, Water supply, Water demand, Water yield, Water quality, Chemical analysis, Hydrology, Lakes, Aquifer characteristics, Groundwater recharge, Water wells, Withdrawal, Domestic water, Agriculture, Streamflow, Runoff.
Identifiers: *Pine Ridge Indian Reservation (S. Dak).

An investigation of the geology and groundwater resources of the Pine Ridge Indian Reservation, South Dakota, was made as part of the U.S. Department of the Interior's program for the development of the Missouri River basin. Emphasis was placed on mapping major rock units and on determining their potential as sources of water for domestic and stock use. Surface water from stock dams, streams, and lakes is used for stock supplies to supplement groundwater supplies or where shallow water-bearing deposits are not present. Water from windblown sand deposits, old terrace deposits, and Tertiary deposits usually contains less than 500 ppm dissolved solids. Water from alluvial deposits, especially those underlain by Cretaceous formations, contains more than 500 ppm dissolved solids and in some places more than 2,000 ppm. Adequate amounts of shallow groundwater for domestic and stock use can be obtained throughout much of the Reservation, particularly in those areas underlain by the Arikaree Formation, Ogallala Formation, old terrace deposits, and windblown sand deposits. The data are presented in a two-sheet hydrologic atlas. (Woodard-USGS)
W72-03905

HYDROLOGY OF THE GENESEE RIVER BASIN, NEW YORK AND PENNSYLVANIA,
Geological Survey, Washington, D.C.
B. K. Gilbert, and J. C. Kammerer.
Geological Survey Hydrologic Investigations Atlas HA-368, 4 sheets, 1971. Text, 26 fig, 6 tab, 22 ref.

Descriptors: *Water resources development, *Hydrologic data, *River basins, *New York, *Pennsylvania, Data collections, Groundwater, Surface waters, Sediment transport, Hydrogeology, Streamflow, Water wells, Water yield, Water quality, Water analysis, Water chemistry, Chemical analysis, Hydrology.
Identifiers: *Genesee River basin (NY and Penn), Hydrologic atlas.

This flow-sheet hydrologic atlas describes the hydrology of the Genesee River basin in New York and Pennsylvania. In 1966 groundwater use in the Genesee River basin averaged about 12 mgd. Stratified sand and gravel deposits occur in the valleys of the Genesee River and many of its larger tributaries. Some of the sand and gravel aquifers are close to the land surface under water-table conditions; others are confined beneath fine-grained deposits of clay and silt and contain water under artesian conditions. Wells drilled in these aquifers may yield as much as 500 gpm. The downstream parts of Black and Oatka Creeks and many wells in the northern part of the basin contain water which has a dissolved-solids content of more than 500 mg/l. The dissolved-solids content of Lake Ontario at Rochester is about 200 mg/liter, and that of the Genesee River at Rochester varies between 200 and 500 mg/liter. The average annual sediment discharge of streams in the basin ranges from 75 to 1,100 tons per square mile of drainage area. (Woodard-USGS)
W72-03906

HYDROLOGY OF THE ROSEBUD INDIAN RESERVATION, SOUTH DAKOTA,
Geological Survey, Washington, D.C.
M. J. Ellis, J. H. Ficken, and D. G. Adolphson.
Available from US Geological Survey, Washington, D C 20242 - $1.50 per set. Geological Survey Hydrologic Investigations Atlas HA-355, 2 sheets, 1971. Text, 1 fig, 7 map, 4 tab, 11 ref.

Descriptors: *Water resources development, *Groundwater, *Indian reservations, *Hydrogeology, *South Dakota, Water yields, Water quality, Chemical analysis, Water users, Domestic water, Agriculture, Aquifers, Aquifer characteristics, Hydrology, Water wells, Withdrawal, Groundwater recharge.
Identifiers: *Rosebud Indian Reservation (S. Dak).

An investigation of the geology and groundwater resources of the Rosebud Indian Reservation, South Dakota, was made as part of the U.S. Department of Interior's program for the development of the Missouri River basin. Emphasis was palaced on mapping the distribution of the major water-bearing deposits and determining their potential as sources of water for domestic and agricultural use. An adequate source of supply, for this investigation, is defined as an aquifer capable of providing a minimum sustained yield to domestic and stock wells of 5 gpm; wells used for limited supplemental irrigation, 50 gpm; and wells and springs in the report area yield water of satisfactory quality for most uses. However, in some areas, the water-bearing beds in contact with

the Pierre Shale yield water that is unsuitable for some domestic and agricultural uses because of high dissolved solids, sulfate, nitrate, iron, manganese, or selenium content. The data are presented in a two-sheet hydrologic atlas. (Woodard-USGS)
W72-03907

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 5. HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS, VOLUME 2, UPPER MISSISSIPPI RIVER BASIN ABOVE KEOKUK, IOWA.
Geological Survey, Washington, D.C.

Available from GPO, Washington, DC 20402-$3.75 (paper cover). Geological Survey Water-Supply Paper 1914, 1971. 750 p, 1 fig, 1 plate.

Descriptors: *Data collections, *Surface waters, *Streamflow, *Mississippi River, Stream gages, Lakes, Reservoirs, Stage-discharge relations, Low flow, Peak discharge, River basins.
Identifiers: Surface water records, Upper Mississippi River basin.

One of a series of 37 reports presenting records of stage, discharge, and content, of streams, lakes, and reservoirs in the United States during the 1961-65 water years, this report covers the upper Mississippi River basin above Keokuk, Iowa. The data generally comprise a station description and a table showing daily discharge and monthly and yearly discharges. The station description gives the location of the gaging station, drainage area, records available, type and history of gages, average discharge, extremes of discharge, and general remarks. Type of gage currently in use and datum of the gage above mean sea level, and a condensed history of the types, locations, and datums of previous gages used during the record period are listed. Conditions affecting natural flow and information on accuracy of records are noted. Tables give daily, average, and extreme discharges and yearly totals and peak discharges. (Myers-USGS)
W72-03909

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 4. ST. LAWRENCE RIVER BASIN, VOLUME 1. BASINS OF STREAMS TRIBUTARY TO LAKES SUPERIOR, MICHIGAN, AND HURON.
Geological Survey, Washington, D.C.

Available from GPO, Washington, DC 20402 - $3.50 (paper copy). Geological Survey Water-Supply Paper 1911, 1971. 651 p, 1 fig, 1 plate.

Descriptors: *Data collections, *Surface waters, *Lake Superior, *Lake Michigan, *Lake Huron, Streamflow, Lakes, Reservoirs, Stream gages, Stage-discharge relations, Low flow, Peak discharge.
Identifiers: Surface water records, St. Lawrence River basin.

One of a series of 37 reports presenting records of stage, discharge, and content of streams, lakes, and reservoirs in the United States during the 1961-65 water years, this report covers the basins of streams tributary to Lakes Superior, Michigan, and Huron. The data generally comprise a station description and a table showing daily discharge and monthly and yearly discharges. Station descriptions give the location, drainage area, records available, type and history of gages, average discharge, extremes of discharge, and general remarks. Type of gage currently in use and datum of the gage above mean sea level, and a condensed history of the types, locations, and datums of previous gages used during the record period are listed. Conditions affecting natural flow and information on accuracy of records are noted. Tables give daily, average, and extreme discharges and yearly totals and peak discharges. (Myers-USGS)
W72-03910

A FUNDAMENTAL MATHEMATICAL SIMULATION OF WATERSHEDS,
Ohio State Univ., Columbus. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02A.
W72-03911

DATA COMMUNICATIONS: A PRIMER.

Journal of the American Water Works Association, Vol 63, No 8, p 470-480, Aug 1971. 11 p, 9 fig, 8 ref.

Descriptors: *Data transmission, *Data transmission systems, Reviews, Communication, Data processing, Computers, Automatic control, *Digital recording, Instrumentation, Information, Codes, Standards, Modulation, Reliability, Performance, Telephones, Carriers, Errors, Economics, System analysis.
Identifiers: *Communication systems, *Data processing terminals, Keyboards, Multiplexing.

The fundamentals of data communication systems and the relationship between communication and the fields of computers, data processing, automatic control, and instrumentation are discussed. Most of these systems employ common carrier facilities, either ordinary switched-voice telephone channels or a private-line service leased from a carrier. Among the important factors to consider before setting up any system are: urgency and volume of information, response time, accuracy, terminal locations and types, reliability, and economic justification. Many data communications experts advise potential users that at least a year will be required to design and implement large systems. Therefore, careful planning and systems design must be completed before selecting the first piece of equipment, to achieve maximum utility of a system. (USBR)
W72-03918

WATER RESOURCE OBSERVATORY SOLAR RADIATION DATA-WATER YEARS 1970 AND 1971,
Wyoming Univ., Laramie. Water Resources Research Inst.
V. E. Smith, and T. J. Swartz.
Available from the National Technical Information Service as PB-206 301, $3.00 in paper copy, $0.95 in microfiche. Progress Report, November 1971, 34 p, 1 fig, 1 tab, append. OWRR A-001-WYO (52).

Descriptors: *Solar radiation, *Wyoming, *Data collections.
Identifiers: *Laramie (Wyo).

Incident, reflected and absorbed solar radiation data from various locations operated by the University of Wyoming in and adjacent to Laramie, Wyoming are presented in tabular form. The period covered is from October 1969 to October 1971.
W72-03989

COMPUTER AND PHYSICAL MODELS FOR SOLVING SUBSURFACE PROBLEMS IN HYDROLOGY,
Wisconsin Univ., Madison, Water Resources Center.
For primary bibliographic entry see Field 02F.
W72-03990

DEVELOPMENT OF A SIMULATION MODEL FOR STORMWATER MANAGEMENT,
Metcalf and Eddy, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 05B.
W72-04022

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 15. ALASKA.
Geological Survey, Washington, D.C.

GPO, Washington, D C 20402 - Price $2.50 (paper cover). Geological Survey Water-Supply Paper 1936, 1971. 342 p, 1 fig, 1 plate.

Descriptors: *Data collections, *Surface waters, *Streamflow, *Alaska, Stream gages, Lakes, Reservoirs, Stage-discharge relations, Low flow, Peak discharge.
Identifiers: Surface water records.

This is one of a series of 37 reports presenting records of stage, discharge, and content, of streams, lakes, and reservoirs in the United States during the 1961-65 water years. The data generally comprise a station description and a table showing daily discharge and monthly and yearly discharges. The station description gives the location of the gaging station, drainage area, records available, type and history of gages, average discharge, extremes of discharge, and general remarks. Type of gage currently in use and datum of the gage above mean sea level, and a condensed history of the types, locations, and datums of previous gages used during the period of record are listed. Conditions affecting natural flow and information on accuracy of records are noted. Tables give daily, average, and extreme discharges and yearly totals and peak discharges. Water-quality records also are collected at or near some gaging stations. (Myers-USGS)
W72-04038

COASTAL BATHYMETRIC PLOTTING FINAL REPORT,
North American Rockwell Corp., Downey, Calif.
D. T. Hodder, P. B. Chandler, and G. A. McCue.
Available from NTIS, Springfield, Va. 22151, as AD-730 830 $3.00 paper copy; $0.95 in microfiche. North American Rockwell Corporation, Space Division Report SD 71-763, September 30, 1971. 66 p, 26 fig, 5 ref, 2 append. Task No NR 387-048 (3-9-70 (414)). Contract No N00014-70-C-0370 ONR.

Descriptors: *Bathymetry, *Bathythermographs, *Oceans, *Shallow water, *Coasts, Photography, Analytical techniques, Turbidity, Bottom sediments, Geomorphology, Marine geology, Oceanography, Remote sensing.
Identifiers: Bathymetric plotting, Coastal waters.

Improved passive techniques were developed for automatic bathymetric plotting in turbid, relatively shallow coastal waters. Initially the technique uses narrower slicing (200 Angstrom units) bandpass interference filters than have been utilized before in multispectral photography of coastal waters. This was done to reject all of the non-image forming light for bottom photography. Coupled with this was an attempt to adequately characterize (for calibration of the plotting) the water column by a modulation transfer function derived either from laser or photographic techniques. Finally, widely-spaced repetitive imagery of identical sites under randomly varying conditions of the water column transmission properties were employed to linearly combine (by computer) film isodensity contours. These isodensity contours may be due to combinations of suspended sediment and bottom relief. The former are considered random variations and the latter relatively stable features. This statistical approach yielded a superior estimate of actual depth contours, since the random sediment effects average out and the bottom features reinforce. Additive multicolor processing techniques were examined and found to require normalization for use in the image merging from the multiple missions. This led to an additional spectral reflectivity difference ratioing concept for depth determination and characterizing coastal waters. (Woodard-USGS)
W72-04045

DOSAG-I, SIMULATION OF WATER QUALITY IN STREAMS AND CANALS. PROGRAM DOCUMENTATION AND USERS MANUAL.
Texas Water Development Board, Austin. Systems Engineering Div.
For primary bibliographic entry see Field 05B.

W72-04047

08. ENGINEERING WORKS

8A. Structures

INTERPRETATION OF ELECTRICAL RESISTIVITY LOGS IN A TWO-ZONE CYLINDRICALLY SYMMETRIC GEOMETRY,
Hawaii Univ., Honolulu. Water Resources Research Center.
L. J. Shamey, and W. M. Adams.
Technical Report No. 46, March 1971. 48 p., 10 fig, 2 tab, 2 append.

Descriptors: *Electrical resistance, *Logging (Recording), *Computer programs, Model studies, *Hawaii, Analytical techniques, Drilling, *Drill holes.

A two-zone theoretical model, consisting of cylindrical bore hole filled with drilling mud and surrounded by homogeneous, isotropic rock, was studied to aid interpretation of electrical resistivity logs. Apparent resistivities are numerically calculated as a function of the rock and the drilling mud resistivities and the separation of the electrodes on the coaxial measuring sonde. For practical use, the inverse, interpretation problem must be solved. Therefore, graphs for finding the true matrix resistivity--given the hole diameter, mud resistivity, and electrode spacings--are presented for ranges applicable to Hawaiian conditions. The interpretation may be done with the interpolative digital computer program provided.
W72-03762

THE OPTIMIZATION OF WATER RESOURCES DEVELOPMENT, II,
California Univ., Los Angeles. School of Engineering and Applied Science.
For primary bibliographic entry see Field 06A.
W72-03763

A CATALOG OF ITALIAN DAMS,
V. A. Romanova.
Available from National Technical Information Service, Springfield, Va. 22151 as TT-70-57260, $3.00 in paper copy, $0.95 in microfiche. Trans. of Italyanskie Plotiny: System-Aticneskii Ukazatel. Leningrad, 'Energiya', 1967. 78 p. NSF Contract C466.

Descriptors: *Dams, *Hydraulic structures, *Engineering structures, *Documentation, *Bibliographies, Reservoirs, Water yield, Height, Dimensions, Volume.
Identifiers: Dams (Italy), USSR, Catalog (Dams).

Information on 325 Italian dams of 20 m and more height, constructed up to July 1, 1967 are presented as an aid in the construction of dams in the USSR. The dams are grouped together according to the types (arch-101, concrete gravitational-96, stone foundation on cement solution-44, dry masonry-15, ground-28, light gravitational-11, counterfort-15, stone talus-4, dams from large concrete blocks-3 and temporary-8). Dams under each type are arranged in alphabetical order. Other information includes the river, province, and region in which the dam is located, its height, length along the crest, its volume, volume of the water reservoir, year of completion and references. A bibliography (in Italian) consisting of 456 references is included. (Woodard-USGS)
W72-03883

TUNNEL LINING WITH PUMPED CONCRETE,
For primary bibliographic entry see Field 08F.
W72-03921

PROTECTION OF OPEN RESERVOIRS AGAINST BIRDS,
Tacoma Dept. of Public Utilities, Wash.
For primary bibliographic entry see Field 05G.
W72-03960

MEASURING WATER PERMEABILITY OF MASONRY WALLS,
Naval Civil Engineering Lab., Port Hueneme, Calif.
H. Hochman.
Available from NTIS, Springfield, Va 22151 as AD-731 353 $3.00 paper copy; 95 cents microfiche. Naval Civil Engineering Laboratory Technical Note N-1179, August 1971. 6 p, 2 fig. YF 51.543.006.013.

Descriptors: *Retaining walls, *Permeability, *Seepage, *Masonry, *Sealants, Testing, Methodology, Dams, Construction.

The Dunwell procedure for determining the water permeability of masonry walls was modified so that it improved reproducibility, decreased the testing time from 3 to 4 days to less than one hour and did not mar the painted surface. These improvements resulted from the elimination of the possibility of air entrapment in the reservoir and finding a sealant that produces a leak-free system immediately and could be washed off with common solvents. The procedure consisted of applying a cylinder of water to a masonry surface and measuring the rate of disappearance of water into that surface. When the rate of disappearance was less than 1 gal/sq ft/hr there were no damaging effects. When the rate exceeded this figure damaging effects were produced. A satisfactory coating system, when properly applied, consists of a styrene-butadiene fillcoat followed by a styrene-acrylate topcoat. (Woodard-USGS)
W72-04036

PRELIMINARY DESIGN OF A MECHANICAL--DRAFT COUNTERFLOW COOLING TOWER,
ARO, Inc., Arnold Air Force Station, Tenn.
R. L. Clouse.
Available from NTIS, Springfield, Va. 22151 AD-731 193, $3.00 in paper copy; $0.95 in microfiche. Arnold Engineering Development Center Technical Report AEDC-TR-71-213, October 1971. 33 p, 19 fig, 13 ref. Contract F40600-72-C-0003 AEDC.

Descriptors: *Cooling towers, *Water cooling, *Heat transfer, *Engineering structures, *Structural designs, Mathematical studies, Draft tubes, Hydraulic structures, Water temperatures, Water reuse.
Identifiers: *Cooling tower design, Mechanical-draft counterflow.

A direct solution to the Merkel equation, when combined with detailed experimental data, yields a quick and straightforward method of establishing the preliminary design of a mechanical-draft counterflow cooling tower. Special attention is devoted to cooling tower applications for high altitude engine test facilities. The information should be very useful to the design engineer in obtaining the preliminary design of a mechanical-draft counterflow cooling tower. By using this method, an estimate of the required physical size of a cooling tower can be obtained quickly, thus allowing important conclusions to be made concerning feasibility. (Woodard-USGS)
W72-04046

WAVE ACTION AND BREAKWATER LOCATION SUPERIOR ENTRY, DULUTH-SUPERIOR HARBOR, SUPERIOR, WISCONSIN, HYDRAULIC MODEL INVESTIGATION,
Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W72-04049

8B. Hydraulics

EXPERIMENTAL AND THEORETICAL STUDY OF THE HYDRODYNAMICS OF DISPERSION IN RIVERS AND ESTUARIES,
Hydronautics, Inc., Laurel, Md.
For primary bibliographic entry see Field 05B.
W72-03540

A COMPARISON OF FLUVIAL AND COASTAL SIMILITUDE,
Tetra Tech, Inc., Pasadena, Calif.
For primary bibliographic entry see Field 02J.
W72-03594

SCOUR AROUND A CIRCULAR CYLINDER DUE TO WAVE MOTION,
Naval Civil Engineering Lab., Port Hueneme, Calif.
For primary bibliographic entry see Field 02J.
W72-03600

WIND SHEAR-TURBULENCE AND REAERATION COEFFICIENT,
Williams (Clyde E.) and Associates, Inc., South Bend, Ind.
A. F. Eloubaidy, and E. J. Plate.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 98, No HY1, Paper 8651, p 153-170, January 1972. 9 fig, 26 ref, append. NSF Grant GK2142.

Descriptors: *Reaeration, *Winds, *Waves (Water), *Turbulence, Mass transfer, Hydraulic models, Turbulent flow, Diffusion.
Identifiers: Wind shear (Water surface).

An equation to predict reaeration rates in natural streams and rivers with wind blowing along the water surface is theoretically developed and experimentally tested. The model used in the experimental development of the equation consisted of interfacial layers of water that absorb gas at a rate proportional to an effective diffusion coefficient at the interface. This surface water is then carried into the main body of liquid by the action of turbulence beneath the water surface. The experimental results support the theoretically developed equation. Reaeration rates are significantly increased when waves appear on the surface. The increase is often much more than can be accounted for by the increase in surface area. The increase is attributed to the dynamic effect of waves and the wind-induced surface shear stress. (Knapp-USGS)
W72-03841

STREAMLINES IN TWO-DIMENSIONAL LAMINAR BRANCH FLOWS,
Papua and New Guinea Univ., Port Moresby. (New Guinea).
D. C. Blest.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 98, No HYl, Paper 8656, p 171-180, January 1972. 2 fig, 1 tab, 5 ref, append.

Descriptors: *Laminar flow, *Eddies, *Viscosity, *Viscous flow, Closed conduit flow, Hydraulics, Open channel flow.

A study is made of two-dimensional laminar flow in a long channel when fluid is extracted or allowed to leak from a small side channel. The full Navier Stokes equations are linearized about a plane Poiseuille flow (which exists in the main channel in the absence of the branch) and solved for the entire flow by a relaxation procedure. It is found that, in the neighborhood of the branch entrance, there are a number of regions of closed circulation. Their presence is accounted for by the viscous nature of the fluid and eludes inviscid calculations. A physical interpretation of these flow characteristics should provide a basis for predicting the flow behavior in complex branching systems. (Knapp-USGS)
W72-03846

SPATIALLY VARIED FLOW OVER SIDE-WEIRS,
Indian Inst. of Tech., Kanpur. Dept. of Civil Engineering.
K. Subramanya, and S. C. Awasthy.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 98, No HY 1, Paper 8627, p 1-10, January 1972. 7 fig, 2 tab, 4 ref. append.

Descriptors: *Weirs, *Discharge coefficients, *Open channel flow, *Subcritical flow, Stage-discharge relations, Discharge (Water).
Identifiers: Side-weirs.

An experimental investigation of the flow over sharp edged side-weirs in rectangular channels covers subcritical and supercritical flow regimes with weirs of zero as well as finite height. The subcritical experimental data agree well with the derived analytical expression for the variation of the De Marchi coefficient with the Froude number of the main channel flow. The De Marchi coefficient for the side-weirs of finite height is essentially the same as for the corresponding side-weir of zero height. (Knapp-USGS)
W72-03849

FLOW OF LAYERED FLUID OVER BROAD CRESTED WEIR,
Canterbury Univ., Christchurch (New Zealand). Dept. of Civil Engineering.
I. R. Wood.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 98, No HY 1, Paper 8649, p 87-104, January 1972. 12 fig, 5 ref. append.

Descriptors: *Stratified flow, *Weirs, *Open channel flow, Thermal stratification, Reservoirs, Withdrawal, Density stratification, Discharge (Water), Viscosity, Mixing, Water quality, Diffusion, Turbulence.
Identifiers: Broad-crested weirs.

The case of two stable layers flowing from a reservoir through a contraction with a round-crested weir at its minimum width is considered. The fluid is considered as inviscid and the flow gradually varied. The conditions under which a single layer may be separated from a two-layer system by having this lighter layer only flow over the weir are first obtained; the conditions under which the two layers continuously decrease from the reservoir to and downstream of the weir are then used to obtain the solution for the flow of the two stable layers. In both cases, the geometry of the weir and contraction is important. Experiments verify the major conclusions of the theory. (Knapp-USGS)
W72-03850

HYDROLOGIC-MORPHOMETRIC RELATIONSHIPS FOR A SYSTEM OF DELTA ARMS (GIDROLOGO-MORFOMETRICHESKIYE ZAVISIMOSTI DLYA SISTEMY DEL'TOVYKH RUKAVOV),
State Oceanographic Inst., Moscow (USSR).
For primary bibliographic entry see Field 02J.
W72-03891

INFLUENCE OF A DROP IN SEA LEVEL AND OF CHANNEL STRAIGHTENING ON THE HYDROLOGIC REGIME IN LOWER REACHES OF THE SULAK RIVER (VLIYANIYE PADENIYA UROVNYA MORYA I SPRYAMLENIYA RUSLA NA GIDROLOGICHESKIY REZHIM NIZOV'YA REKI),
State Oceanographic Inst., Moscow (USSR).
For primary bibliographic entry see Field 04A.
W72-03898

MODEL INVESTIGATION OF THE STATIC BEHAVIOR OF A NEW TYPE OF TRUSSED CELLULAR FRAME,
A. I. Svetilov, and B. V. Orlov.
Hydrotechnical Construction, No 1, p 36-39, Jan 1971. 4 p, 3 fig.

Descriptors: Foreign research, *Model studies, *Structural design, *Dams, Reinforced concrete, Costs, Deformation, Strain, Design, Construction, *Construction methods, Model tests, *Structural models, Retaining walls, Foreign design practices.
Identifiers: USSR.

A new type retaining structure of reinforced concrete prismatic blocks would require half the concrete currently used in light structures. Each block is made of three 8-m-long precast trussed slabs erection-welded at the corners to form a rigid frame. From the end view, the slabs form a hollow right triangle with a 4.0-m-long horizontal leg and a 4.20-m-long vertical leg. To achieve stability, the hollows of the triangular sections would be filled with earth. By properly assembling the triangular shapes, a dam with a vertical upstream face and a sloping downstream face can be constructed. A reinforced concrete 1:10 scale model of a 27-m-high dam was built to evaluate the operating characteristics of the new structure. The model was loaded and strains and movements recorded. Conclusions were: (1) the prismatic block manufacturing and erection techniques are satisfactory, (2) the trussed cellular frames have high overall strength, and, (3) the forces observed in the model agree with those determined analytically. (USBR)
W72-03914

COMPUTER AND PHYSICAL MODELS FOR SOLVING SUBSURFACE PROBLEMS IN HYDROLOGY,
Wisconsin Univ., Madison, Water Resources Center.
For primary bibliographic entry see Field 02F.
W72-03990

STUDIES IN DOUBLE ASYMPTOTICS AND STRATIFIED FLUID FLOW,
Wisconsin Univ., Madison. Dept. of Mathematics.
For primary bibliographic entry see Field 02E.
W72-03991

ESTIMATION OF WAVE PARAMETERS AT MARINE CONSTRUCTION,
Institute of Sea Transport, Moscow (USSR). State Research Project.
Yu M. Krylov, S. S. Strekalov, and V. F. Tsyploukhin.
ASCE Proceedings, Journal of the Waterways, Harbors and Coastal Engineering Division, Vol 97, No WW 4, p 793-796, November 1971. 2 fig, 4 ref, append.

Descriptors: Waves (Water), *Ocean waves, *Surf, Winds, Coasts, Refraction (Water waves), Shore protection, Coastal engineering.
Identifiers: *USSR.

For the purpose of engineering calculations a new method of wave parameter calculation was developed at 'Sojuzmorniiproject' and State Oceanographic Institute (USSR). The initial data required for determining wave parameters and wave conditions are information on wind, bathymetric maps of marine structure site, and also tables, graphs and nomograms of wave parameters (height, period, length). Wave conditions in the coastal zones have a number of features associated with the refraction of waves in shallow water. There are two basic types of coastal zones. The first type is characterized by a rather straight coastal line with isobaths which follow the outline of the coast. The second type represents the coast of sinuous form with similar sinuous isobaths (bays, capes). Spectral calculating methods and modeling of wave conditions are presently finding increased use in the USSR for solving various practical problems. (Knapp-USGS)
W72-04024

WAVE ACTION AND BREAKWATER LOCATION SUPERIOR ENTRY, DULUTH-SUPERIOR HARBOR, SUPERIOR, WISCONSIN, HYDRAULIC MODEL INVESTIGATION,
Waterways Experiment Station, Vicksburg, Miss.
H. B. Wilson.
Available from NTIS, Springfield, Va 22151 AD-728 095, $3.00 in paper copy; $0.95 in microfiche. Army Engineer Waterways Experiment Station Technical Report No 2-616, January 1963. 75 p, 1 fig, 33 plate, 11 tab, 6 ref.

Descriptors: *Waves (Water), *Lake Superior, *Model studies, *Breakwaters, *Navigation, Ships, Storms, Retaining walls, Engineering structures, Harbors.

The Superior Harbor Basin and ore docks, Superior Entry and outer harbor, and enough of adjacent areas of Lake Superior to ensure accurate simulation of approaching waves were reproduced in a 1:150-scale model equipped with wave-generating and wave-height-measuring devices. The model was used to determine the optimum length and location of breakwaters lakeward of Superior Entry that would provide, at minimum cost, protection against storm waves for ships navigating the entry or berthed at the Great Northern Railway ore docks opposite the entry in the inner harbor. The plan was also required to satisfy navigation requirements. It was concluded that a single detached breakwater 900 ft long, aligned N55 deg W, with its easterly (outer) end located 2100 ft lakeward of the existing entrance and 300 ft southeast of the center line of navigation approach channel, would provide the desired degree of protection. (Woodard-USGS)
W72-04049

8C. Hydraulic Machinery

WATER POLLUTION FROM OIL SPILLS CAN BE PREVENTED.
For primary bibliographic entry see Field 05G.
W72-03749

ARRESTER PROTECTION OF HIGH VOLTAGE DC TRANSMISSION SYSTEM CONVERTER TERMINALS,
General Electric Co., Pittsfield, Mass.
J. S. Kresge, E. C. Sakshaug, and S. A. Miske, Jr.
Institution of Electrical and Electronics Engineers Transactions, Power Applications Systems, Vol PAS-90, No 4, p 1555-1562, July-Aug 1971. 8 p, 10 fig, 4 ref, append, disc.

Descriptors: *Direct current, Extra high voltage, Transmission lines, *Converters (Electrical), *Protection (Electrical), *Lightning arresters, *Electrical design, Electrical faults, Electric discharges, Bus (Electrical), Transmission (Electrical).
Identifiers: *Electric converter stations, *Bipolar transmission lines, Pacific Northwest-Southwest Intertie, Sparkover, Surge diverters, Lightning protection, Over voltage.

Proper coordination and protection of d-c converter stations can be attained only through the cooperative efforts of systems engineers and arrester designers. This has been the case during the development of protective applications for a-c systems and, because of the lack of practical field experience, is particularly pertinent to HVDC systems. From an energy standpoint, the duty required of d-c arresters can be severe for HVDC converter stations involving series-connected valve groups feeding long transmission lines. To design arresters that will provide adequate protection, designers must be aware of the conditions under which the arresters may be required to operate. The specification, design, and testing of arresters for the HVDC Pacific Northwest-Southwest Intertie are discussed. A description of the overvoltage events affecting arrester design and the resulting specifications is included. Basic d-c arrester design problems and the techniques used to overcome them are reviewed. (USBR)
W72-03919

SIX MONTHS EXPERIENCE WITH A PRESSURE SEWER SYSTEM DEMONSTRATION,
New York State Dept. of Environmental Conservation, Albany. Environmental Quality Research and Development Unit.
For primary bibliographic entry see Field 05D.
W72-03962

DETROIT AIMS FOR SAVINGS WITH PURE OXYGEN AERATION,
Detroit Metro Water Dept., Mich.
For primary bibliographic entry see Field 05D.
W72-03972

8E. Rock Mechanics and Geology

A LARGE CYLINDRICAL DREDGE,
Akademiya Nauk SSSR, Moscow. Institut Okeanologii.
L. A. Filippov, I. A. Kraush, M. S. Barash, V. M. Lavrov, and L. V. Dmitriyev.
Okeanologiya, Vol 11, No 1, p 140-142, January-February 1971. 2 fig.

Descriptors: *Dredging, *Sampling, Oceans, Design, Mechanical equipment, Rock.

A new dredge has been designed to collect coarse clastic material from ocean bottoms, or to detach samples from rock projections. The dredge is a steel cylinder, 1000 mm in diameter, 1500 mm long, with 12 mm thick walls, two 12 mm thick rings welded to the outside for strength, and rounded teeth (blades) cut into the forward part of the dredge which is the end of the cylinder. The cylindrical dredge, which was fitted for shipboard operation, was successfully tested on the R/V Akademik Kurchatov. The advantages over bottom grabs or the rectangular dredge are a smaller contact area with the substrate and relatively large weight to sink into the bed to engage rock projections firmly or to scrape up rock fragments. The teeth on the cylindrical dredge are relatively weak projections of the forward edge of the cylinder which can bend backwards to prevent breakage. The volume from a single dredging was 1.7 cu m and weighed 5 tons. (Jefferis-Battelle)
W72-03564

8F. Concrete

MODEL INVESTIGATION OF THE STATIC BEHAVIOR OF A NEW TYPE OF TRUSSED CELLULAR FRAME,
For primary bibliographic entry see Field 08B.
W72-03914

TUNNEL LINING WITH PUMPED CONCRETE,
L. H. Tuthill.
Journal of the American Concrete Institute, Proceedings, Vol 68, No 4, p 252-262, Apr 1971. 11 p, 10 fig, 6 ref.

Descriptors: *Tunnel lnings, *Concrete mixes, *Tunnel construction, Construction methods, Pozzolans, Gradation, Preventive maintenance, Construction equipment, Tunnels, Concrete construction, Pumps, Construction joints, Vibration, Concrete technology.
Identifiers: Pumped concrete, Tunnel inverts, Internal vibrating, Slip forms, Slump, Crushed stone.

Satisfactory concrete placement in tunnel linings can be achieved by using the proper equipment, concrete mix, and construction procedures. Concrete for the tunnel invert should be placed first unless the invert is essentially horizontal from side to side. The invert concrete should be placed using a slip-form and have about a 2-1/2-in slump. Rigorous sandblasting of the joint between the invert and the sidewalls assures a fully bonded monolithic joint. The slump of the sidewall and crown concrete depends upon the construction procedures used. In many situations, a concrete pump is better than pneumatic equipment for placing tunnel lining. ACI 613-54 and the USBR Concrete Manual are recommended as guides for obtaining pumped concrete mix proportions. The concrete mix must contain enough mortar to keep the coarse aggregate separated and enough fines to keep the pipe lubricated. Proper procedures must be used to consolidate the tunnel lining concrete. Equipment maintenance is essential to avoid delays in pumping operations. (USBR)
W72-03921

MECHANIZATION OF CONCRETE MIX COMPACTION DURING CONSTRUCTION OF LARGE DAMS,
E. V. Lavrinovich, A. Ya. Luskin, and N. Ya. Tsukerman.
Hydrotechnical Construction, No 1, p 18-23, Jan 1971. 6 p, 6 fig, 6 tab, 3 ref.

Descriptors: Dams, Mechanization, *Construction methods, *Vibrators (Mechanical), Foreign research, Densification, Concretes, *Compaction, Dam construction, Costs, *Concrete construction, *Concrete dams, Mass concrete, *Concrete placing, Concrete technology.
Identifiers: *Concrete compaction, Leveling, Output, Segregation.

Studies of mechanized equipment vs. hand-held vibrators for compacting nonreinforced concrete showed a decrease in the unit volume cost by a factor of from 2 to 9 in favor of mechanization. Compaction equipment investigated included: (1) light hand-held single-shaft vibrators, (2) strengthened hand-held single-shaft vibrators, (3) powerful tractor- or crane-held single-shaft vibrators, (4) planar vibroradiators, and (5) horizontal continuous vibrators. Increasing the power of the single-shaft vibrator results in an increase in the hourly compaction output, but the overall cost savings is offset by the high cost of suspending the vibrator. Greater power single-shaft vibrators have other shortcomings: vibrations are inadequately transmitted, and concrete mixes become segregated. A planar vibroradiator consists of a rigid plate caused to vibrate perpendicular to its plane by 2 single-shaft vibrators. The zone of action of the planar vibroradiator is from 1.5 to 2 times greater than for 2 independently operating single-shaft vibrators of equal size. Horizontal continuous compactors are ordinary single-shaft vibrators equipped with devices for drawing them horizontally through a layer of concrete mix. (USBR)
W72-03924

8G. Materials

CRITICAL POTENTIAL FOR GROWTH OF LOCALIZED CORROSION OF STAINLESS STEEL IN CHLORIDE MEDIA,
Akinomoto Co. Inc., Kawasaki (Japan). Central Research Labs.
T. Suzuki, and Y. Kitamura.
Corrosion, Vol 28, No 1, p 1-6, January 1972. 14 fig, 12 ref.

Descriptors: *Corrosion, *Chlorides, *Chemical potential, *Electrolysis, *Pitting (Corrosion), Desalination, Metallurgy, Saline water, Corrosion control.
Identifiers: *Stainless steel.

Investigations were carried out to determine the critical potentials for the growth of localized corrosion on Type 316 and Type 316L stainless steel in chloride media using artificial specimens having the macroscopic local anode separated from the cathode. The critical potential value for the pitting in 0.5 NaCl solution at 70 C was approximately -0.25 V to a saturated calomel electrode, and that for the crevice corrosion was about -0.36 V SCE. Crevice corrosion was nearly equal to the critical potential for the crack propagation of stress corrosion cracking in boiling 35% MgC12 solution. The critical potential can vary, depending on the degree of occlusion on the anode. The critical potential seems to be determined mainly by the hydrogen ion concentrations inside the occluded anodes. The critical potential for pit growth was not as affected by the environmental factor as the pitting potential. (Knapp-USGS)
W72-03853

EFFECTIVE GRAIN SIZE AND UNIFORMITY COEFFICIENT'S ROLE IN PERFORMANCE OF INTERMITTENT SAND FILTERS,
New York State Dept. of Environmental Conservation, Albany. Environmental Quality Research and Development Unit.
For primary bibliographic entry see Field 05D.
W72-03963

MEASURING WATER PERMEABILITY OF MASONRY WALLS,
Naval Civil Engineering Lab., Port Hueneme, Calif.
For primary bibliographic entry see Field 08A.
W72-04036

8I. Fisheries Engineering

ORIFICE PLACEMENT IN GATEWELLS OF TURBINE INTAKES FOR BYPASSING JUVENILE FISH AROUND DAMS,
National Marine Fisheries Service, Seattle, Wash.
Kenneth L. Liscom.
Trans Amer Fish Soc. 100 (2): 319-324. Illus. 1971.
Identifiers: Bypassing, Dams, Fish Gatewells, Intakes, Juvenile, Oncorhynchus-Kisutch, Oncorhynchus-Spp, Oncorhynchus-Tshawytscha, Orifice, Placement, Salmo-Gairdneri, Turbine.

Four locations of an orifice within a turbine intake gatewell were tested to determine which was the most effective in facilitating the passage of fingerling Pacific salmon (Oncorhynchus spp.) and steelhead trout (Salmo gairdneri) from the gatewell into an adjoining trash sluice. The orifice positions tested with natural light were: center of gatewell, 1.5-m depth; corner of gatewell, 1.5-m depth; center of gatewell, 4.6-m depth and corner of gatewell, 4.6-m depth. Hatchery-reared coho salmon (O. kisutch) placed in the gatewell and wild chinook salmon (O. tshawytscha) and steelhead trout that migrated downstream and entered the gatewell were used to evaluate response to different placements. The most effective location was in the corner of the gatewell at a depth of 1.5 m. Changes from natural to artificial lighting did not improve passage. A darkened gatewell with artificial light over the orifice did affect passage efficiency, however, and should receive careful attention in any future application of a gatewell bypass system.--Copyright 1971, Biological Abstracts, Inc.
W72-03795

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

WATER RESOURCES RESEARCH INTERESTS IN THE COLLEGES AND UNIVERSITIES OF NORTH CAROLINA.
North Carolina State Univ., Raleigh. Water Resources Research Inst.

Available from the National Technical Information Service as PB-206 127, $3.00 in paper copy, $0.95 in microfiche. Water Resources Research Institute Report No. 3 (Revised), UNC-WRRI-71-03, July 1, 1971, 41 p. OWRR A-999-NC (25).

Descriptors: *North Carolina, *Education, *Universities, *Colleges, Schools (Education), Engineering education, Training, *Projects, Programs, *Water Resources Development.

An inventory is presented of water-related research interests in the following North Carolina colleges and universities: Consolidated University of North Carolina-North Carolina State University at Raleigh, University of North Carolina at Chapel Hill, University of North Carolina at Charlotte, University of North Carolina at Greensboro, University of North Carolina at Wilmington; Campbell College, Chowan College, Duke University, East Carolina University, Guilford College, North Carolina Central University at Durham, St. Andrews Presbyterian College at Laurinburg and Western Carolina University. This report is revised annually. (Howells-North Carolina)
W72-03535

INVENTORY OF ACTIVE WATER RESOURCES RESEARCH PROJECTS IN NORTH CAROLINA.
North Carolina State Univ., Raleigh. Water Resources Research Inst.
For primary bibliographic entry see Field 09D.
W72-03536

MAINE FOUNDATION MARKS TWENTY YEARS OF EDUCATION AND RESEARCH.
For primary bibliographic entry see Field 05D.
W72-03725

9D. Grants, Contracts, and Research Act Allotments

WATER RESOURCES RESEARCH INTERESTS IN THE COLLEGES AND UNIVERSITIES OF NORTH CAROLINA.
North Carolina State Univ., Raleigh. Water Resources Research Inst.
For primary bibliographic entry see Field 09A.
W72-03535

INVENTORY OF ACTIVE WATER RESOURCES RESEARCH PROJECTS IN NORTH CAROLINA.
North Carolina State Univ., Raleigh. Water Resources Research Inst.

Available from the National Technical Information Service as PB-206 228, in paper copy, $0.95 in microfiche. Water Resources Research Institute Report No. 4 (Revised), UNC-WRRI-71-04, July 1, 1971, 103 p. OWRR A-999-NC (26).

Descriptors: *North Carolina, *Education, Universities, Colleges, Training, *Projects, *Industries, Programs, *Federal government, *State governments, *Water Resources Development.

This report summarizes all water-related studies and research currently underway in North Carolina. It includes federal and state agencies, private industry, and all of the State's senior colleges and universities. Project summaries include organization, investigator (for universities), descriptions, and starting and estimated completion dates. (Howells-North Carolina)
W72-03536

THE CURRENT STATUS OF RESEARCH ON WATER AND SALT SOLUTIONS,
Carnegie-Mellon Univ., Pittsburgh, Pa.
For primary bibliographic entry see Field 01B.
W72-03773

10. SCIENTIFIC AND TECHNICAL INFORMATION

CARBONATION IN SODIUM BASE PULPING LIQUID RECOVERY PROCESSES,
For primary bibliographic entry see Field 05D.
W72-03633

ARID-LANDS INFORMATION IN UNITED STATES GOVERNMENT-SPONSORED INDEXING TOOLS: WHAT. WHERE. WHEN. HOW,
Arizona Univ., Tucson. Office of Arid-Lands Research.
For primary bibliographic entry see Field 03F.
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A REGIONAL BIBLIOGRAPHY OF CALCRETE,
Oxford Univ. (England). School of Geography.
For primary bibliographic entry see Field 03F.
W72-03675

GLACIOLOGICAL LITERATURE.
For primary bibliographic entry see Field 02C.
W72-03881

CYBERNETIC AND GENERAL-SYSTEM APPROACHES TO URBAN AND REGIONAL SCIENCE: A REVIEW OF THE LITERATURE,
Manchester Univ., (England). Centre for Urban and Regional Research.
For primary bibliographic entry see Field 06A.
W72-03953

BIBLIOGRAPHY OF WATER QUALITY RESEARCH PROJECT REPORTS.
Environmental Protection Agency, Washington, D C. Office of Research and Monitoring.
For primary bibliographic entry see Field 05G.
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INTRACELLULAR PH,
North Carolina Univ., Chapel Hill. Dental Research Center.
For primary bibliographic entry see Field 05D.
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A. Center of Competence		
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University of Washington, Water Quality Requirements for Aquatic Organisms	W72-03520	1
AEC Oak Ridge National Laboratory, Nuclear Radiation and Safety	W72-03521--03524	4
Batelle Memorial Institute, Methods for Chemical and Biological Identification and Measurement of Pollutants	W72-03541, 03543--03552 03554--03561 03563--03564 03567--03568	23
American Water Works Association Research Foundation, Public Water Supply Treatment Technology	W72-03542, 03562 03565--03566 03585, 03617 03640, 03679 03683, 03687 03689, 03698--03700 03702--03707 03716--03719 03722, 03724 03726, 03745--03746 03748, 03756 03759, 03822--03824 03826, 03828--03834 03838, 03916, 03923 03960--03961 03999--04019 04072, 04075 04082, 04096 04102	74
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B. State Water Resources Research Institutes		
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Maine Water Resources Center	W72-03987	1
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Delaware Water Resources Center	W72-03997--03998	2
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CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U. S. Geological Survey, U. S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the Soap and Detergent Association and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Public water supply treatment technology at the American Water Works Association.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural livestock wastes at the Department of Agricultural Engineering of Iowa State University.
- Methods for chemical and biological identification and measurement of pollutants at the Analytical Quality Control Laboratory of the Environmental Protection Agency.
- Coastal pollution at the Oceanic Research Institute.
- Water treatment plant waste pollution control at American Water Works Association.

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

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